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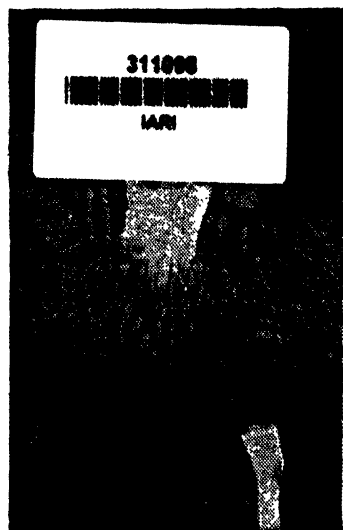
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SOCIETY OF SCOTLAND

WITH
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* * *It is to be distinctly understood that the Society is not responsible for the views, statements, or opinions of any of the Writers whose Papers are published in the 'Transactions.'*

JOHN STIRTON,
Secretary.

8 HOLINTON CRESCENT,
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TRANSACTIONS
OF
THE HIGHLAND AND AGRICULTURAL
SOCIETY OF SCOTLAND

THE MAINTENANCE OF SOIL FERTILITY.

By PROFESSOR J. A. SCOTT WATSON, Oxford University.

It is recognised that one of the likely consequences of the war is a serious decline in the general level of fertility of the farm lands of this country, as well as of those of most European countries.

The increased production of sale crops, such as grain and potatoes, will necessarily cause a greater drain of plant food from our farms. The seriously reduced supplies of imported feeding-stuffs must imply either smaller numbers of stock or smaller rations, and in either case reduced amounts of manurial residues for the soil. As regards artificial fertilisers, we have more than normal quantities of nitrogen at our disposal, and we are fortunate, by comparison with continental countries, in our resources of phosphate; but potash will necessarily be in short supply as long as the war lasts. Again, the shortening of leys, in order to provide more plough land, involves the risk that the turf, when it is ploughed in, will contain smaller stores of nitrogen and humus. Finally, we must reckon on a growing scarcity of skilled labour, resulting possibly in less efficient cultivation. This, in conjunction with the more frequent succession of white straw crops, will tend to an increase in weeds. Clearly, then, we must take all possible measures to avoid the post-war problem of land that will be 'run out' in all three senses of the term—more or less exhausted of plant food, depleted of humus, and foul. This article attempts to suggest some possible ways of minimising

the consequences of present conditions, and of making the best use of our restricted resources.

THE TEMPORARY LEY.

Scottish farmers have long accepted the general arguments in favour of temporary grass, as these are now being so strongly urged by Sir George Stapledon for other parts of Britain. The arguments are that temporary grass, with reasonably efficient management, produces more and better keep than could be got from permanent pasture on the same land; that the ploughing in of a turf is the cheapest way of maintaining the organic-matter content of the soil and of supplying nitrogen; and that the alternation of grass and arable is a useful means of controlling weeds. It is the strongest argument for better leys, under present conditions, that increased production of grass herbage is perfectly compatible with greater benefit to the soil. A good crop of grain or potatoes takes more out of the soil than a small one; a good sward of grass not only carries more stock than a poor one, but gives a richer turf to plough down, and does more to suppress weeds. One of our chief aims must be to produce better swards. We may, therefore, summarise the more important measures necessary to this end.

Nurse Crops.—The term *nurse crop*, which suggests that grass and clover seedlings get some benefit from the protection of a crop of corn, is, of course, a misnomer. Grass seeds produce better swards, and produce them more quickly, if they are sown alone. The growing grain competes with the seedling grasses both for soil moisture and plant food, and it deprives them, to a greater or less degree, of the sunlight on which all plant growth depends. The ideal, so far as the sward is concerned, would be to dispense with the nurse crop altogether. Obviously, however, under present conditions, the land that is being laid down should be sown with grain if there is any probability of even a moderate crop. The best that we can do is to grow the variety of grain that is least likely to do harm, and to manure the land with some consideration for the needs of both corn and grass.

A point that Mr William Findlay has shown to be of vital importance in all the upland and late districts is that the grain—usually oats in such areas—should be of an early ripening variety. The object is to give the young grass plants the longest possible spell of sun and warmth in the back-end of the seeding year—i.e., between harvest and the first frosts. Where harvest is late and winter comes early, the interval tends to be too short, and an extra week or ten days in August or September may make all the difference between good and

poor establishment of the grass. A second and much more widely recognised point is that the corn should have short and stiff straw, and be not too leafy. So far as oats are concerned, Findlay has shown that Yields has the best combination of all these qualities. For good land at low elevation there is a wider choice. Yields, on the light soils and in dry seasons, is apt to ripen prematurely and to give a rather poor crop. On the other hand Victory is too weak in the straw. Among the possibilities are Star, Onward, Elder, and possibly Record.

Competition between Species.—Mixtures for short leys must contain quick-growing species if a full crop, either of pasturage or hay, is to be produced in the first harvest year. The quickest-growing species, that produce the greatest bulk in young grass, are ordinary broad red clover and Italian ryegrass. These plants are strong growers, and, if they are allowed to reach full development, have the same adverse effects upon the slower-growing but longer-lived grasses and clovers that a heavy and leafy nurse crop exerts on the grasses and clovers as a whole. The damage will not occur if the sward is reasonably well grazed in its first year, for the ryegrass and red clover then bear the brunt of the grazing and get no chance to smother out the slower-growing plants. Damage will be inconsiderable if the sward is cut at the proper time for silage—i.e., perhaps three weeks before it would have reached the hay stage. It will be material, but not beyond remedy, if the hay is cut at the normal time. A late-cut crop of hay greatly weakens, or even kills out, the more permanent plants, more particularly the wild white clover. The consequence is a poor and thin sward. A heavy aftermath that is left growing too long has an equally bad effect.

Seasonal Grazing.—The risk of lattermaths reaching an overgrown condition is probably not serious under war conditions unless the weather is quite exceptional. A much more likely thing is that swards will be punished by over-grazing during the winter and early spring. This seriously weakens the perennial ryegrass, and greatly reduces the summer growth, whether of hay or pasture. There are many sound old proverbs about the dangers of over-stocking with sheep—dangers both to the health of the sheep themselves and to the productivity of the pastures on which they graze. It seems that many farms in Scotland have, in recent years, reached the upper limit of sheep numbers.¹ In such cases it will be necessary to reduce the flocks in proportion to the shrinkage of the pasture area. Only if this is done can the fields get the necessary periods of rest, in winter and early spring, to enable a proper balance to be maintained between the various species

¹ For instance, the number of ewes in Aberdeenshire increased from 70,000 in 1918 to 161,000 in 1928.

in the mixture and leave the plants strong enough, in spring, to make full use of the growing season.

Seed Mixtures.—With the uncertainty about the duration of the war, and about post-war farming conditions, it is often impossible to decide how long a particular field of grass will be allowed to lie. The farmer who normally sows out for three or four years may, under present conditions, be tempted to use a cheap mixture on the argument that the ley may probably be down for two years only, and that, at present seed prices, the field will not repay the cost of a really good mixture. In fact, however, there are few parts of Scotland where a cheap mixture will produce a good two-years' ley. The most costly items of the normal three-year mixture are wild white clover and cocksfoot, and the obvious economy would be to substitute Dutch white for the former and to omit, or to reduce, the amount of the latter. But Dutch white clover, in many districts, fails to survive into the second year, and the absence of clover in the second year's sward has a very harmful effect on the ryegrass. On the poorer land, ryegrass alone, or even in combination with wild white, cannot be relied upon to maintain a close sole in the second year. There are therefore strong reasons for adhering to the well-tried mixture—including cocksfoot, timothy, and wild white clover in addition to the ryegrasses and red clovers. It will often be better economy to sow, on those fields that can best stand the plough, a simple mixture of the ryegrasses and red and alsike clover to lie for one year only, and to use, for other fields, normal mixtures that can lie for three years or more.

It is well known that the quantities of grass seeds that are ordinarily sown allow a considerable margin of safety. Under really favourable conditions for germination and establishment two-thirds of the normal seed-rate will produce a close sward. In view of the scarcity and high price of seeds it may be well worth while to spend rather more money and to take more care in the preparation of the land, and to use a smaller seeding. The main conditions for good establishment, apart from questions of manuring which are discussed below, are the fineness and firmness of the seed-bed and the depth at which the seeds are placed. A 'take' of clover is especially dependent on a firm tilth, and the smallest seeds, such as those of timothy and wild white clover, can easily be too deeply buried—so deeply that the seedlings never reach the surface. It is often a difficult matter to get a satisfactory seed-bed after the later crops of swedes. If these have been fed on the land to sheep, the tilth is often knotty; if they have been 'sheuched,' and carted late, part of the soil may be too loose and part of it hard trodden or puddled by the cart wheels. In either case it is worth considering the use of a disc harrow in addition to the usual standard tools. The

disc has come into great favour in most parts of Britain as a war-time implement. It is most useful in dealing with ploughed-up old grass, because it cuts up the surface layer and at the same time packs down the furrows. But this same action—the firming of the lower soil and the cutting up of surface clods—is just what is needed to obtain a good bed for grass seeds.

Manuring.—The problem raised by the scarcity of potash is not a serious one in reference to leys. The general run of sown grasses and clovers makes no very large demands, and land that has been reasonably well farmed in an ordinary rotation will generally have enough reserves to meet their needs. The exception is red clover, which is apt to fail altogether under potash-deficiency conditions. If the land has been dunged for the preceding root crop, or if the roots have been fed on the ground, the difficulty is unlikely to arise. But if the soil is light or gravelly, and if the roots have been grown without dung and have been carted off, then it is unwise to rely on a satisfactory growth of red clover without a dressing of potash, and this is unlikely to be available for such a purpose during the rest of the war period. Some good may probably be done by an application to the young grass, after the grain harvest, of 5 or 6 cwt. per acre of common salt. Salt has the effect of making available some part of the soil's potash reserve, a point that is dealt with below in relation to sugar beet. There seem to have been no properly recorded experiments on the value of salt for young grass, but occasional observation seems to support the suggestion that a dressing might often be worth its small cost. A further precaution, when potash deficiency is to be feared, is to substitute alsike for a considerable part of the red clover in the mixture.

The importance of phosphate in the establishment of grass, and especially of wild white clover, is too well known to require emphasis, and most farmers also know the particular form—superphosphate, ground mineral phosphate, or basic slag—that answers best on their particular soil. Broadly, superphosphate is to be preferred for light land that is not acid, basic slag for clays, and mineral phosphate for rather acid soils in the wetter districts.

In a well-balanced mixture of clover and grass the clover should, during the greater part of the growing season, collect enough nitrogen not only for its own needs but for those of the grasses as well. But the early grasses are liable to suffer from a deficiency of nitrogen in the early spring—*i.e.*, before the clover has started into growth. Hence a small dressing of readily available nitrogen, applied in March, will in most years produce earlier spring growth. If this growth is well grazed there will be no harmful results on the subsequent growth of clover, so that its effect, apart from giving food at

a time when this is valuable, is to increase the total output of keep for the season, and hence the amount of manurial residue. On the other hand, top-dressing for the hay crop must be done with care, especially if the mixture contains any substantial amount of Italian ryegrass. Too large a dose of nitrogen increases the height and the leafiness of this grass, and therefore aggravates the risk that it may choke out the wild white clover.

WINTER FODDER CROPS.

The general arguments that have been advanced for better pastures apply equally to the roots and other fodder crops grown for winter stock food. The area of land available for these crops will be less by reason of the necessity of growing more potatoes and cereals, and the stock-carrying capacity of the farm will be reduced unless this decreased acreage can be compensated by heavier crops. We must also bear in mind that the farmyard manure applied to these crops will, as long as the war lasts, be below normal quality, owing to the shortage of imported cakes. The deficiency will be mainly in nitrogen. It appears, therefore, that heavier applications of artificials, and especially of nitrogen, are called for. In a recent publication Crowther and Yates¹ have summarised the results of all the recorded fertiliser experiments that have been carried out in Great Britain, and their conclusions are of great importance in relation to war-time food production. These conclusions, for the more important Scottish crops, with additional information and suggestions in certain cases, are set out below.

Swedes.—As regards the use of nitrogen on swedes, there is a rather common belief that the main effect is to increase the growth of shaws, and that maximum crops of bulbs can be produced by the very moderate use of artificials. This view is not confirmed by experiments. Crowther and Yates express the response of crops to nitrogen in terms of an application of 1·2 cwt. of sulphate of ammonia per acre. They find only slight differences between one part of Britain and another, and they conclude that, on the average, the standard dressing of 1·2 cwt. applied to a dunged crop (10 tons of dung per acre) increases the yield of roots by 2·3 tons. The response in the absence of dung is practically the same. It is obvious that, at present price levels of fertilisers and feeding-stuffs, such a return would be highly profitable.

Carrying the argument a stage further, these authors arrive at a conclusion about the most profitable amount of sulphate

¹ E. M. Crowther and F. Yates. "Fertiliser Policy in War-time." 'Empire Journal of Experimental Agriculture,' April 1941.

of ammonia to apply. Assuming that this fertiliser costs 12s. 6d. per cwt. (including the cost of application), and that swedes are worth 23s. per ton on the land, the most profitable dressing for the crop, whether it has or has not received dung, is about $2\frac{1}{2}$ cwt. of sulphate of ammonia per acre, which gives, on the average, an increase in the yield of roots of very nearly four tons.

Apart from the fact that responses to fertilisers vary from farm to farm, there are certain practical considerations that must be borne in mind in deciding the rate of application in particular cases. On the one hand, it is fairly certain that the dry-matter content of swedes, and hence their feeding value, is deteriorated to some extent by heavy dressings of nitrogen. There is unfortunately no exact evidence of the amount of the decline in food value per ton, but it is unlikely that this would be enough to influence materially the above conclusion. On the other hand, extra nitrogen does increase the growth of leaf, which has the double advantage of easing the problem of keeping the crop clean and of giving us more material to plough in for the benefit of the following crop. On the whole, then, so long as we are thinking of that portion of the crop that is to be consumed in the early winter, we may probably take the figures at their face value and apply 2, or $2\frac{1}{2}$ or 3 cwt. of sulphate of ammonia, per acre, according to the general condition of the land.

As regards the part of the crop that is to be kept till the late winter and spring, there are the important additional considerations of frost-resistance and keeping qualities. Even if we select the hardiest and longest-keeping varieties we shall still run a serious risk of loss if we dose with nitrogen heavily enough to produce anything like the maximum yield. Here, then, it will generally be better for each farmer to adhere to the level of nitrogen manuring that past experience has taught him to be reasonably safe.

As would be expected, the review of experiments shows that swedes are highly responsive to phosphates. The most remarkable effects are obtained in the wetter districts, and particularly on acid soils where phosphatic fertilisers tend to revert quickly to insoluble and unavailable compounds. In Scotland, Wales, and the South-West of England, the average response to a standard dressing of 3 cwt. of superphosphate (or its equivalent in the form of basic slag or mineral phosphate) is three tons of bulbs per acre in the case of crops that have received dung, and nearly six tons an acre in the absence of dung. The most profitable dressing, on the assumption that superphosphate costs £5 per ton, was calculated at fully 6 cwt. per acre with dung, and nearly 9 cwt. per acre for undunged crops. The latter dressing produced an average increase of fully nine tons per acre.

There is no question, with phosphates, of causing any deterioration in feeding or keeping quality. Moreover, a dressing of phosphate to the root crop leaves substantial residues for the grain and the grass seeds that ordinarily follow. Hence, so far as available supplies will permit, the farmer on good land in the drier arable districts should think in terms of 6 cwt. of superphosphate per acre. In upland districts and on poorer land, and especially where a ley is to be sown in the year after the roots, the dressing should be either half a ton of basic slag or some 7 to 8 cwt. of ground mineral phosphate. The latter is the cheaper source of phosphate even if we take account of the slag subsidy, and should have preference wherever it is known to be effective—*i.e.*, in the wetter districts and on rather acid soils.

It is, of course, impossible to say whether the available supplies of phosphate, during the remainder of the war period, will enable these heavy applications to be made by the general run of farmers. But there is no doubt that both foreign exchange and shipping space should be made available for phosphatic fertilisers in preference to animal feeding-stuffs or even to human food. Actually, phosphates have been given a very high priority in the list of imports.

It is improbable that potash will be available for such crops as swedes during the remainder of the war. Supplies cannot approach normal levels, and the return from applications, in terms of human food, will be highest if the great bulk of whatever potash comes to hand is applied to the potato crop. In Scotland, indeed, swedes that are grown without dung, and especially on the lighter soils, benefit considerably from potash. The average increase obtained from a standard dressing of 1 cwt. of muriate, in the case of undunged crops, is about three tons of roots per acre. Moreover, the quality is somewhat improved in certain cases. If any potash should be available for swedes, it should be used for undunged crops on light land.

Marrow-stem Kale.—In recent years there has been a distinct tendency for Scottish farmers, and especially milk producers, to grow marrow-stem kale on some small part of their root breaks, the crop generally replacing part of the yellow turnips. There are strong arguments for carrying this substitution a stage further under war conditions. If we are to state both sides of the case we have, of course, to admit that the turnip is a better fattening food than kale. The dry matter of turnips contains only some 10 per cent of fibre, and this is of a type that is largely digestible by both sheep and cattle. The dry substance of kale contains nearly 25 per cent of fibre, and some part of this is of the less easily digestible type. The consequence is that, if we feed two lots of bullocks or hogs on equal amounts of cake and hay, and

allow them to eat kale or turnips, as the case may be, up to the limit of their appetite, those fed on turnips will put on the higher live-weight increases and will reach butcher condition sooner. In other words, turnips are a really concentrated food whereas kale is more bulky.

On the other hand, if we manure both crops up to the most profitable level, the kale will produce substantially more dry matter per acre. A comparison on the basis of total yield per acre is misleading. Thus a twenty-ton crop of yellow turnips might contain 36 cwt. of dry matter per acre, providing about 23 cwt. of starch equivalent. The same weight of kale would contain 57 cwt. of dry matter and provide 33 cwt. of starch equivalent. There can thus be no question that, if kale can be made to produce anything approaching the same gross yield per acre as turnips, the amount of food produced will be substantially greater.

Again, if turnips are the better-balanced food for fattening purposes, kale is better balanced for milk production, and also for growing young stock that are otherwise kept largely on straw. Kale is the better source of calcium and other minerals, and supplies an abundance of carotene, in which turnips are very deficient. Moreover, kale has substantially the better protein content; about one-sixth of the total dry matter is crude protein, as against one-ninth or one-tenth in turnips.

There are other points in favour of kale. The plant, when well grown, covers the ground more completely than turnips and hence can be kept clean with less labour. In fact no crop does more to suppress weeds. It is more resistant to finger-and-toe than the commoner varieties of turnips, and, when once established, suffers much less from drought. But the great merit of kale under war conditions, and also under those that may probably prevail in the post-war period, is that it is the most efficient of all crop plants in converting sulphate of ammonia, which is abundant, into protein, which is scarce. The stock-carrying capacity of our farms, and the quantity and quality of the dung that can go back to the soil, will depend largely, and for some time, on the amount of protein that our farms themselves can produce. There are, of course, other means to the end in view—the partial substitution of beans for oats and of grass silage for hay. But no crop can compare with kale in its yield of protein per acre; this is, for instance, fully half as large again as that of beans.

In some cases kale has been tried and given up, but, where this has happened, it has too often been manured in the same general way as the root crop. In fact its manurial requirements are rather markedly different. An ordinary turnip dressing, applied to kale, both fails to produce a full yield and leaves

the land exhausted, as is shown by the growth of the following crop. Kale is a 'greedy' crop. It should be dunged, unless it is grown on turf; it gives roughly the same response to phosphate as swedes; but it should ordinarily have considerably more nitrogen. Three cwt. of sulphate of ammonia per acre, or the equivalent amount of other nitrogen manure, should be the minimum, and in many experiments the most profitable level of nitrogen manuring has been 5 or 6 cwt. per acre.¹ Up to 3 cwt. per acre may be applied at sowing time and the balance as one or two top-dressings. It is true that such generous treatment lowers the dry-matter content of the plant, but it gives a higher proportion of leaf and therefore a higher protein and lower fibre content; on the whole, then, the feeding quality may be improved rather than otherwise. The only reservation that must be made applies to such part of the crop as is to be consumed late—from December onwards. If a very lush growth has been produced the plant suffers severe damage from hard frosts. Kale for late consumption should therefore be less heavily manured with nitrogen. Incidentally the crop does remarkably well on ploughed-up turf.

Mangolds.—The mangold crop can probably never play a large part in Scottish farming, but it is worth noting that the area grown has more than trebled during the past decade. Considerable success in its cultivation has been achieved in the south-west, and also along the eastern side of the country as far north as Angus. Small patches are to be found even in Morayshire and Easter Ross. The crop is undoubtedly valuable for bridging the gap between swedes and pasture, and there are many cases where perhaps as much as 5 per cent of the root break could usefully be devoted to it.

The balance of the fertiliser mixture used for mangolds is different from that appropriate to swedes. Less phosphate and more potash is the ordinary rule, but, as with sugar beet, potash can be replaced, with completely satisfactory results, by common salt. Under average conditions the most profitable dressing, with dung, is about 3 cwt. of sulphate of ammonia, 3½ cwt. of superphosphate, and 4 cwt. of common salt. Where no dung has been applied the phosphate should be increased to 6 cwt. and the salt to about the same figure. Mangolds are almost as sensitive to acid conditions as sugar beet, and may fail completely on land that is well enough supplied with lime to grow good crops of swedes. Liming must therefore not be forgotten if there is any doubt on the score of soil

¹ Trials at the Midland College from 1933 to 1936 gave the following results, where varying quantities of sulphate of ammonia were added to a basal dressing of dung, phosphate, and potash:—

No Nitrogen	30.1 tons
3 cwt. Nitro-chalk	33.1 "
6 " " " " " " " " " " " "	36.2 "

sourness. Again, as with sugar beet, early cultivation to destroy weeds, and early singling, are very important points in management. In most parts of Scotland storage cannot be safely delayed later than the first half of October.

CATCH CROPS.

One of the main objects of agricultural propaganda in Germany is to increase the cultivation of catch crops for stock feeding. "Three crops every two years" is one of the slogans of the German Ministry of Agriculture. But, of course, the possibility is governed almost entirely by climate, and in the uplands and north of Scotland catch-cropping is not worth consideration. It is only the milder and earlier districts that come in question. The growing of catch crops after early potatoes is, of course, an old-established practice, but something more can be done by the undersowing of grain crops which are to be followed by grain crops again or by roots. The choice of plants is limited; in most districts and in ordinary seasons only two can produce a substantial amount of growth between harvest and winter. These are broad-leaved red clover and Italian ryegrass. The argument for including clover is, of course, that it fixes some nitrogen, but its growth practically comes to an end with the first frost. Italian ryegrass, on the other hand, is little affected by frost and may often be seen green and growing during mild spells in winter. Lambs thrive surprisingly well on stubbles that have been sown with ryegrass, eating not only the grass itself but also the shed grains or broken ears of corn and many of such weeds as may be present. The total amount of keep will rarely be large, but if an acre can provide a fattening diet for two or three lambs over a period of two or three weeks, with the possibility of a good bite for ewes later on, it may be worth the few shillings that the seed would cost. Moreover, the ryegrass roots add something to the soil humus. Half a bushel of Italian ryegrass is a sufficient seeding.

THE 'STRUCTURE OF AGRICULTURE' IN RELATION TO SOIL FERTILITY.

So far the general argument of this paper has been that we should endeavour to produce more stock food per acre on the reduced area of land that will be available for the purpose, and that the chief means to this end must be a substantial increase in the use of artificial fertilisers, and particularly of nitrogen. Better grass and heavier forage crops will enable us to maintain a substantial proportion of our cattle and

sheep, and hence to return to the land something approaching normal amounts of animal manure.

But let us now suppose that the current changes in our farming must proceed further—that the acreage under wheat and potatoes must continue to increase. And let us suppose that the new type of farming must continue for some time after the peace. These things are more than possible. The nation will be a good deal poorer at the end of this war than it was at the beginning. We have already parted with a considerable proportion of our overseas investments, and it will take some years to readapt our factories to peace-time production and to rebuild our export trade. We shall be in no position to pay for food imports on the pre-war scale. In all probability our consumers will have to be content for some years with the plainer type of diet to which they are at present becoming accustomed—a diet that includes increased quantities of bread, oatmeal, potatoes and vegetables, and smaller amounts of meat, bacon, eggs, and fruit. Supposing that farmers must concentrate on the production of grain and potatoes for a period of years, and must face a semi-permanent reduction in the numbers of their herds and flocks, need we fear a disastrous decline in the fertility of our soil?

There are perhaps three ways in which we may seek an answer. Firstly, we may make a comparison between the agriculture of our own country in the pre-war period with that of another country in which economic conditions were, at that time, somewhat similar to those that we must expect during the present war and for some years after peace—conditions under which it will be difficult for us to obtain or to pay for imports. Secondly, we may compare the structure of our industry, as it has been in recent years, with that of an earlier time when the country was more largely dependent on home-grown food and when the general standard of living was considerably lower than before the present war. Thirdly, we may consider the results obtained by particular farmers in this country who, for one reason or another, have been running their farms on unconventional lines, concentrating on the production of food crops rather than on live stock.

BRITISH AND GERMAN AGRICULTURE IN 1936-38.

In 1916 Sir Thomas Middleton wrote a Memorandum¹ drawing a comparison between the farming systems of Germany and Britain in the period preceding the Great War. The broad conclusions were that German agricultural land produced considerably the greater amount of food per acre,

¹ 'The Recent Development of German Agriculture' (Cd. 8305). Board of Agriculture, 1916.

calculated in terms of food values, whereas the British system produced by far the larger output, calculated in terms of money values, per man employed. The Memorandum has sometimes been taken to imply that German agriculture was more efficient than our own, but this it by no means does. The one system was conditioned by low wages and a large demand for the cheapest food-stuffs such as potatoes and rye bread; the other by the necessity to pay a comparatively high wage, and by the availability of a good market for costly foods such as dairy produce, beef, lamb, bacon, eggs, and fruit.

The contrast between the two countries has been accentuated in recent years, Germany having turned more and more to grain, potatoes, and vegetables, while we, up till 1939, turned more and more to live stock and grass. Partly this was because we succeeded to a considerable extent in rebuilding our export trade in manufactured goods after 1918, while Germany failed to rebuild hers; partly it was because, in the immediate pre-war years, Germany's agricultural policy was based on her intention to make war, while ours was founded mainly on hopes of continuing peace. In Germany a vast amount of effort has been devoted to the securing of a balance between food production and food consumption. On the one hand there has been a vast programme of research, education, and propaganda, all designed to increase the output of food, with little or no regard to the cost; on the other, German consumers have been deliberately reduced, for many years past, to the barest possible ration of the cheapest possible foods that could be produced either within the Reich's own boundaries or in those countries which Germany might expect to conquer or to dominate. Meanwhile we took only a few hesitating steps to save our land from the ruin that threatened it by reason of the flood of food that came to Britain because there was no other country in which it could be sold.

We are not here concerned with the whole problem of food production in peace and war, but only to ask ourselves whether, or under what conditions, we could carry on, without disastrous effects on the fertility of our soils, a system of farming in which food crops would play a much larger and live stock a much smaller part.

The following table sets out the percentage distribution of the main groups of crops on the agricultural land (excluding mountain land and rough grazings) in Germany and in Great Britain. It gives the numbers of cattle, sheep, and pigs on the average hundred acres. It shows the total quantities of fertilisers, expressed in terms of chemical elements, applied to the average hundred acres in each case. Finally, it gives, in each case, the ten-year average yields of wheat and potatoes

—two crops whose productivity depends largely on the level of soil fertility.

CROPS AND LIVE STOCK PER HUNDRED ACRES (1937).		
	Germany.	Great Britain.
Crops (acres)—		
Grain (including peas and beans)	41	17½
Potatoes and vegetables	11	3
Sugar beet, oilseed, and other industrial crops	2½	1½
Total crops, mainly for human food	54½	22
Roots, forage crops, temporary grasses, &c.	13½	16
Permanent grass	31	60½
Total crops for stock food	44½	76½
Bare fallow	1	1½
	100	100
Live stock (head)—		
Total cattle	28	30
„ sheep	7	54 ¹
„ pigs	37	14
CONSUMPTION OF FERTILISERS PER HUNDRED ACRES (1936).		
Pounds of total nitrogen, phosphorus, and potassium	9800	4500
MEAN YIELDS OF CROPS PER ACRE, 1928-37.		
Wheat (cwt.)	17·4	18·0
Potatoes (tons)	6·3	6·7

Thus in Germany more than half the agricultural area was devoted to crops for human food as against less than a quarter in Britain. The German farmer kept rather fewer cattle and far fewer sheep, though many more pigs. Incidentally he used much smaller amounts of imported feeding-stuffs. Nevertheless, *by using more than twice as much artificial fertiliser as the British farmer*, he was able to get yields of the more exacting crops that were only some 5 per cent lower than our own.

It is, of course, possible to raise numbers of points that might affect the validity of a comparison such as this—points concerning the innate fertility of German and British soils,

¹ This figure assumes that 40 per cent of the total sheep population of Britain is maintained on mountain pastures and rough grazings.

questions of climate and labour supplies, and possibly others. Moreover there seems now to be some concern, in Germany itself, about the effect on soil fertility of the further intensification of cropping that has been forced on the farmer in the last four years. But even if we make such reservations it must seem that we need not fear any disastrous effects on soil fertility as a result of the changes that are now being made in our farming—provided that we can get the substantially increased quantities of fertilisers that these changes make necessary.

CHANGES IN BRITISH AGRICULTURE, 1871-1937.

It has often been said in recent years that Britain has always been, is, and should remain a pastoral rather than a corn-growing country, because, on the whole, our soils and our climate are better suited to grass than to grain. We are apt to forget how great have been the changes in the last two generations. We have fairly accurate statistics of British agriculture since 1871, and it is a fortunate coincidence that that year came at about the end of a long period of agricultural prosperity during which our industry had reached a very high level of productivity—so high that it was looked up to as an example by practically all Europe. The yields of our crops were then substantially higher than those of any other European country except possibly Holland, and our live stock had already the reputation of outstanding quality. What was the make-up of the industry in those days when farmers thrived and the great bulk of the land of the country was still highly farmed, clean, and in good heart? How does that picture compare with the one we saw in the last years before this war? The following table shows the distribution of crops and grass, and the live stock carried, per hundred acres of agricultural land in 1871 and 1937.

CROPS AND LIVE STOCK PER HUNDRED ACRES OF FARM LAND.
(Excluding Fruit, Vegetables, and Minor Crops.)

	1871.	1937.
Corn crops, including peas and beans	31.4	17.8
Potatoes	2.0	2.1
Sugar beet . . . . .	..	1.1
Turnips, swedes, and mangolds	10.1	3.4
Rotation grasses	14.2	12.7
Permanent grass	40.3	61.0
Bare fallow	1.8	2.0
Cattle	17	30
Sheep	53 ¹	54 ¹
Pigs	8	14

¹ Assuming that 40 per cent of the sheep population was maintained on mountain and rough grazings.

This table does not, of course, indicate the full extent of our growing dependence on imported food, because the human population increased from 26 to 47 millions in the period, while the farmed area fell by about $1\frac{1}{2}$ million acres. Possibly the changes may better be illustrated by taking the actual figures for wheat, barley, and potatoes, the main food crops, and for cattle and sheep, the classes of live stock chiefly concerned in maintaining soil fertility.

The figures are :—

	1871.	1937.	Percentage rise or fall.
1000 acres.			
Wheat	3,572	1,832	49 per cent fall
Barley	2,386	904	62 „ fall
Potatoes	628	591	6 „ fall
1000 head.			
Total cattle	5,328	7,909	48 „ rise
„ sheep	27,120	24,712	10 „ fall

A few other facts may illustrate the changes. In 1871 the country produced 9·7 million acres of grain crops; in 1937, 5·1 million. In 1871 our grandfathers ploughed 14 million acres and had 16·8 million acres in temporary and permanent grass; in 1937 we ploughed 8 million acres and had 21 million in temporary or permanent grass.

In taking crop yields as a measure of soil fertility we must bear in mind the many differences in the conditions of 1871 and 1937. On the one hand the farmers of the earlier period employed more men, who worked much longer hours. Tillage could be more meticulous, and more care could be taken to conserve the fertilising value of farmyard manure and other by-products. Economic conditions—good prices and cheap labour—encouraged the farmer to make the fullest use of such fertilisers as were obtainable. Lime was regularly used in ample quantities: the lime status of the country's soils in 1871 was probably better than it has ever been since, and was certainly far better than in 1937. Phosphatic fertilisers had been in abundant supply, and had been largely used, for half a century, and most soils must have had considerable reserves. Nitrogen manures were relatively expensive, but what with nitrate of soda, sulphate of ammonia, guano, and imported linseed and cotton cakes, together with the regular cultivation of clover in the rotation, the nitrogen supply was not inadequate; it became a matter for anxiety only towards the turn of the century, and the invention of

synthetic processes came in time to solve the problem. Finally, our land in 1871 was far better drained than it has been in recent years.

On the other hand, supplies of potash fertilisers were negligible,¹ and the marked effects of their application, when they became available a few years later, shows that some of the lighter soils in the country must have been seriously potash deficient. Again, the varieties of crop plants in 1871 were definitely less productive than those of recent times. On the better soils the Potato oat does not yield as heavy a crop as Victory, Chevallier Barley cannot compare with Plumage Archer, and, on many soils, Yeoman or Victor wheat will considerably outyield the old Squarehead, which was the most widely cultivated sort in the 'seventies. There was no wild white clover seed in 1871. The common varieties of potatoes were very susceptible to potato disease. Other diseases that are now preventible—bunt in wheat, smut and leafstripe in oats and barley—took a heavier toll of the crops. The last and most important fact is that the arable land of those days, because the area was so much larger, must necessarily have included a large proportion of inherently poor or difficult soil—light sand, thin stony soil, and very heavy clay. The natural quality of the arable land in 1871 must have been, on the average, considerably lower than that of 1937.

There are no official estimates of the yields of British crops earlier than 1884; an average of the estimates of various writers during the seventies would put the British yield of wheat at about 28 bushels, of barley at about 32, and of oats at a little less than 40. The official figures for the first five years after estimates began to be made give the following average yields, which are compared with the averages for 1928-37:—

BUSHELS PER ACRE.

				1894-98	1928-37
Wheat	.	.	.	29.6	32.2
Barley	.	.	.	33.2	33.7
Oats	.	.	.	37.2	43.9

All things considered, it would seem that the country's soil was in a higher state of fertility in 1871 than it is to-day.

The conclusion that may reasonably be drawn from all

¹ Imports of potash from Germany became considerable between 1875 and 1880.

this seems to be that if we could adequately drain and lime our land, restore its depleted reserves of phosphate, and keep it as clean and as well tilled as our grandfathers kept it, then we might, without fearing any serious decline in fertility, raise our arable area by some five or six million acres, and reduce our live-stock population by the equivalent of two million cattle.

Farming to-day with less Live Stock.—Certain present-day writers—notably Sir Albert Howard—are very insistent on the vital necessity of maintaining a high humus content in the soil. This is to be achieved either by making composts, or by keeping a heavy head of cattle and applying large amounts of farmyard manure, by ploughing in turf, by folding sheep, or other such means. The contention is that a soil lacking in humus is an ‘unhealthy’ soil, which produces unhealthy crops; and that the produce of these crops, in turn, produces unhealthy generations of animals and men. There appear to be no scientific facts in support of this contention. Thus the wheats from the Broadbalk plots at Rothamsted have been fairly exhaustively examined for vitamin content and baking quality, and there is no indication that the withholding of organic manures from the soil, over a period of about a century, has led to any deterioration in the nutritive value of the grain.

So far as concerns the yields of crops, the importance of maintaining a high level of organic matter in the soil depends partly on the nature of the soil and partly on the crops that are actually grown upon it. Broadly speaking, on deep soils of good ‘body,’ yields of grain crops can be kept up for long periods on artificial fertilisers alone. On the other hand, it becomes progressively more difficult to make a satisfactory tilth for root crops on the heavier classes of soil as the humus content is allowed to fall. Yields of mangolds, swedes, &c., tend to fall away and to become more variable from year to year, because the securing of a good tilth, and consequently of full germination, becomes more and more dependent on winter frost and spring showers. Potatoes, beans, and red clover are other crops that generally respond well to organic manures. On really light land all crops suffer increasingly, in dry seasons, as the organic-matter content of the soil falls. The need for organic matter is least on deep loams of medium or moderately heavy texture.

The present writer happens to have been associated, for the past nine years, with the management of a fairly large farm. In an average year about two-thirds of the total area has been under white straw crops, chiefly wheat and barley. For the first four years the farm carried no stock; since then a herd of pigs and occasional lots of cattle have provided enough dung to give a dressing each year for about twenty out of the

total of nearly five hundred acres. At the present rate each field might thus get dung once in every twenty-five years. Some of the fields have carried a one-year's crop of ryegrass and clover, the first growth being mown for hay and the second ploughed in as green manure. A considerable number of fields have been farmed on a simple system of two or three grain crops followed by a bare fallow. These have had no organic manure unless that provided by ploughing in the fairly long stubble that is left by the combine harvester. Practically every crop has had a moderately liberal dressing of balanced artificials. There are now signs that the physical character of the soil is beginning to deteriorate. The soil is a difficult one at the best, consisting of a mixture of clay and gravel with, in places, pure gravel underneath. It is extremely sticky when wet, and sets so hard in a dry autumn that it becomes impossible to plough. After rain in autumn it fails to cut cleanly with the plough, and clings to the mould-board. In a dry spring, after a wet and mild winter, it sets into very hard clods.

Where the land has had neither dung nor a clover crop for the past eight or ten years these difficulties are becoming rather more marked. When a showery spring follows a frosty winter there is still no difficulty in getting a good spring tilth; but when winter and spring weather are unfavourable there is a growing necessity to apply forceful methods—to use the disc harrow and the Cambridge roller. For at least two years after a dressing of dung, or a clover root, the soil becomes noticeably easier to manage.

Despite this difficulty (with, of course, the additional one of controlling weeds in a scheme of cropping where one white-strawed crop so often follows another) there is no indication of any progressive decline in the yields of any of the crops; the tendency, in fact, would seem to be in the opposite direction. Incidentally, the farm more than paid its way in the difficult times that preceded the war.

This piece of personal experience confirms the writer in what he believes to be the reasonable view on the humus question—on the need for organic manures, and hence for maintaining a certain balance between live stock and sale crops. This view is that humus can by no means be regarded as the essence of fertility. At least five main things are necessary to keep land in good heart. One of these is the maintenance of the soil humus at a reasonable level, and the level that is reasonable (and profitable) varies with the character of the soil and with the crops that the farmer wants to grow. The others are drains, lime, plant food (phosphates, nitrogen, and potash), and efficient tillage. It is impossible, in this article, to cover the whole field. As regards drainage and liming, there seems to be no need to do so, because farmers

recognise their importance. During the past twenty years these operations have fallen seriously in arrears for no other reason than that farmers could not find the money to carry them out. As regards tillage, we must try to adjust our ideas and methods to the war-time necessity of getting through more work with fewer men. This means more tractors and new implements to go with them. But the subject would require an article to itself.¹ We may therefore conclude with some notes on the use of fertilisers for the main food crops—grain, potatoes, and sugar beet—and on the most profitable use of farmyard manure.

FERTILISERS FOR FOOD CROPS.

Cereals.—Under average farm conditions wheat, barley, and oats all give much larger responses to nitrogen fertilisers than to phosphate or potash. The results of some seven thousand British and Continental experiments, that have been examined by Crowther and Yates, show that a standard application of 1½ cwt. of sulphate of ammonia increases the yield of grain, in the case of all these crops, by about 3½ cwt. per acre. This figure is very constant in the various countries and throughout the various parts of Britain. The value of this increase at present prices is about 51s., and the cost of the application about 15s.

The most profitable level at which to apply nitrogen is, in all cases, the highest that the crop can bear—i.e., the largest amount that can be put on without causing the crop to go down. Unfortunately, of course, this amount can never be determined in advance, because we cannot predict the season's weather. The farmer can only base his estimate on his knowledge about the condition of the particular field and on his past experience. Lea oats following a wild white clover pasture have commonly too much nitrogen rather than too little. A second oat crop after ley, or a crop following roots, can often stand as much as 1½ or 2 cwt., and, on poor land, 2 cwt. or 2½. The modern varieties of barley, such as Plumage Archer, can take about the same amounts. So far as concerns spring grain, the only means of gaining the maximum benefit from dressings of nitrogen is to select the stiffest-strawed varieties that are otherwise suited to the locality and to the purpose for which they are grown. Some, but not all, of the stronger oat straws are of rather poor feeding quality.

As regards wheat, an increased amount of nitrogen can be safely used if this is divided into two dressings, the first being given in March and the second in late May. The early

¹ See, for instance, Cashmore, "Notes on Farm Mechanisation in War-time." 'Journal of the Royal Agricultural Society of England,' Vol. 101, Part II., 1941.

dressing helps the plant to survive the period when it is apt to go off, and is specially helpful in making a thin crop tiller out. But it tends to increase the length of straw and the breadth of leaf. A late top-dressing produces little visible effect on the growing crop, but it helps the plant to fill the ear and usually produces a full response measured in sacks of grain. Many crops will stand 2 or $2\frac{1}{2}$ cwt. of nitrogen manure if this is given in two doses. The second of these should preferably be in the form of Nitro-chalk or nitrate, because these substances produce their effect even if very little rain falls; sulphate of ammonia, on the other hand, does not penetrate to the roots of the grain until there has been a considerable rainfall.

On land that has been reasonably well farmed in rotation, a 3-cwt. dressing of superphosphate produces, on the average of all the recorded experiments, only 1.7 cwt. of extra grain, and has but little effect on the yield of straw. At present prices this would mean a return of some 25s. for an expenditure of fully 15s. on the fertiliser. In ordinary circumstances, then, no great harm will be done if phosphate is withheld altogether. In the case of sown-out crops, a dressing of phosphate may be given to help the grass; but if the preceding root crop has received the sort of application suggested on page 7, then both grain and grass should do very well without any further phosphate.

A clear exception must be made when grain is sown upon ploughed-up poor old turf—i.e., where the sward was showing signs of phosphate shortage. These signs are the absence of wild white clover, with the presence of much bent-grass (*Agrostis*), a late commencement of spring growth, and an absence of the healthy fresh green colour of good pasture. In such cases we may get something approaching a complete failure of cereal crops unless a substantial dressing of phosphate is given. If the application can be made on the plough furrow in early winter, slag or ground mineral phosphate will generally answer well. For spring application superphosphate is to be preferred. In doubtful cases it is well worth while to have the soil tested for available phosphate, and to use the analysis as a guide to the amount of fertiliser to be applied.

The response of grain crops to potash is still less. The average of Scottish experiments shows an increase of only 1 cwt. in the yield of grain from an application of 1 cwt. muriate of potash or its equivalent. In fact, in the majority of experiments there has been no response whatever, and a profitable return is obtained in a few cases only. These are generally found either on light gravelly soils, which are often naturally deficient in potash, or on fields that have been often hayed and rarely dunged in the preceding few years, so that their reserves of available potash have been too heavily

drawn upon. In general it is clear that little harm will come to our grain crops if they receive no potash whatever for a number of years to come.

Sugar Beet.—The average response of sugar beet to nitrogen is 18 cwt. of roots for 1½ cwt. of sulphate of ammonia, which is clearly very profitable; and the most profitable rate of application is fully 3 cwt. per acre. This is roughly true whether the crop be grown with or without dung. The full dressing of 3 cwt. gives an average increase in the crop of 1 ton 16 cwt. Phosphate also gives a highly profitable increase, the optimum dressing being 7 cwt. of superphosphate where no dung has been applied and 5 cwt. where a ten-ton application of dung has been made. In the absence of dung the average increase from the 7-cwt. dressing is nearly two tons of roots per acre.

Beet gives a marked response to potash, but quite as good results are obtainable from common salt. In 1940 a series of twenty-four experiments was carried out on representative soils in Great Britain to test the effects, both each by each and together, of applications of 2½ cwt. per acre of muriate of potash and 5 cwt. per acre of common salt, in the presence of a dressing of 4 cwt. sulphate of ammonia. The results were as follows :—

	Yield of Mashed Roots per acre (tons).	Yield of Sugar per acre (cwt.).
No potash or salt	11·3	42·3
Potash only . . .	12·1	45·7
Salt only	12·5	47·1
Salt and potash .	12·6	47·6

It will be seen that the effect of salt alone was somewhat better than that of potash alone, and that salt alone was almost as good as salt and potash together. Experiments with mangolds have given the same kind of results.

It is not indeed known whether salt would continue to act as a potash substitute if mangolds or beet were to be repeatedly grown on the same land. Indeed a completely satisfactory explanation of the action of common salt on these crops is difficult to produce. But sugar beet and mangolds are not, in the ordinary way, grown at short intervals on the same ground. It is therefore clear that, over the next few years, we require no potash for these crops, and can use the available supplies for other purposes.

Potatoes.—At the current level of market prices the potato

crop gives by far the greatest scope for the profitable use of large quantities of fertilisers. In Scotland it has long been the custom to deal very generously with first earlies, partly to get the crop to bulk early in the season, but partly also because the price of the crop, per ton, is generally high. In the silt-land district of Lincolnshire almost equally heavy dressings—running from 15 to nearly 20 cwt. of mixed artificials per acre—have in recent years become common even for maincrop varieties, whereas many Scottish growers still regard half these quantities as adequate. The difference in practice can be largely explained by the fact that the Lincolnshire grower can generally sell his ware at a substantially higher price than that ruling in Scotland, and that he is less frequently left with a surplus of sound potatoes that can only be used for stock feeding. With a guaranteed price and a guaranteed market the Scottish grower is in a greatly improved position and may confidently manure for a heavier yield.

In order to illustrate the point about the most profitable level of manuring, we may consider in detail the increase in yield of potatoes from progressively increasing doses of sulphate of ammonia applied along with a standard dressing of dung and with moderate and unvarying quantities of phosphate and potash. The following is Crowther and Yates' table of responses, the cash figures being based on a price of £5, 10s. per ton for the crop, a cost of 12s. per cwt. for sulphate of ammonia, and a shilling or two per acre to cover the labour of application.

CASH RETURN FROM THE USE OF SULPHATE OF AMMONIA
FOR POTATOES (PER ACRE).

Dressings of Sulphate of Ammonia	Responses.			Net return.
	Cost.	Tons.	Value	
1·2 (standard)	15s.	0·90	99s.	84s.
2 . .	25s.	1·26	139s.	114s.
3 . .	38s.	1·53	168s.	130s.
4 . .	50s.	1·69	186s.	136s.
5 . .	62s.	1·78	196s.	134s.
6 . .	75s.	1·84	202s.	127s.
7 . .	88s.	1·87	206s.	118s.

It will be seen that the most profitable dressing is 4 cwt. per acre, but that we should make but a small mistake if we applied either 3 cwt. or 5. If, on the other hand, we give

only the standard dressing of 1.2 cwt., we shall be making 52s. an acre less than the maximum possible profit from the use of this particular fertiliser. The most profitable complete dressings, under average Scottish conditions, are, according to the available experimental evidence, as follows :—

	With Dung.	Without Dung.
Sulphate of ammonia	4	4½
Superphosphate	7	9½
Muriate (or sulphate) of potash .	2	2½
Total	13	16½

It should be noted that the particular fertilisers mentioned above are those that should actually be used, unless, indeed, a concentrated complete fertiliser, in appropriately lower amount, is preferred. If ready-made compounds are used, that for the dunged crop, to be applied at 13 cwt. per acre, should contain about 6½ per cent nitrogen, 8½ per cent phosphoric acid, and 8 per cent potash. For use without dung, at the higher rate indicated, the analysis of the mixture should be about 5½ per cent nitrogen, 9 per cent phosphoric acid, and 10½ per cent potash. Many mixtures offered as special potato fertilisers contain too low a proportion of nitrogen and correspondingly too much phosphate.

THE USE OF DUNG.

It is common knowledge that dung can be much more beneficially applied to such crops as swedes and turnips, kale, mangolds, sugar-beet, and potatoes than to grain crops, hay land, or pasture. There is now enough experimental evidence for three of the crops in the first list. In fact they all give the same order of percentage increases in yield from dressings of the common amount—say ten tons (or fourteen ordinary single cart-loads) per acre. The money value of the increase so obtained is, however, very different as between potatoes and the fodder roots if we take the former at the guaranteed price of about £5, 10s. per ton and the latter at consuming value. This consuming value, even at the present level of feeding-stuffs prices, can be placed no higher than 25s. per ton.

The cash values of the immediate returns from ten tons of dung (*i.e.*, neglecting its residual value), when used in con-

junction with the appropriate dressing of artificials, works out as follows :—

	Increased yield per acre (tons).	Value per ton.	Value of increase per acre.	Return per ton of Dung.
Swedes . .	2·6	£1 5 0	£3 5 0	6/3
Mangolds . .	2·7	1 5 0	3 7 6	6/9
Potatoes . .	1·4	5 10 0	7 14 0	15/5

Obviously, then, the ordinary custom, on potato growing farms, of giving priority to potatoes in the matter of dung, is fully justified on financial grounds. It is also, under present conditions, in the national interest.

WAR-TIME STOCK FEEDING.

SOME INVESTIGATIONS AND LESSONS THEREFROM.

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SEVERAL factors contributed to the extremely difficult position in which many stock owners found themselves during the past winter, particularly in the months of February to May, when, owing to a great reduction in imports of feeding-stuffs, a rationing scheme had to be put into operation to ensure that what was available would be utilised to the fullest advantage.

A return to summer grazing has to a very great extent, at least temporarily, solved the problem of feeding most classes of farm stock—*e.g.*, cattle, sheep, and horses. Pigs and poultry, however, cannot subsist on grass alone and they thus still constitute a problem, as they require supplementary feeding, much of which is unfortunately of the nature of potential human food, hence the drastic steps that have been taken to effect material reduction in the pig and poultry population.

There are already indications that the food situation in the winter of 1941-42 is likely to be even more difficult than was the case last winter, not because of a world shortage of food, but because of still lower imports on account of shipping being required for other vital services. It is accordingly imperative that all possible steps be taken with a view to increasing home output of food for man and beast to the utmost possible extent. It is equally important that the food-stuffs available be conserved and utilised in the manner calculated to bring the most useful contribution to the food supply.

Of the factors which, apart from that of transport, have contributed to the very serious food situation, the outstanding one has undoubtedly been *the extent to which the country had allowed itself to become dependent on imports and its failure to develop and make full use of home resources.*

We have taken the easy method of relying on supplies

from overseas, and in so doing have allowed much land that might have made a very real contribution to the food supply to become more or less derelict. Such a state of matters is, *at any time*, far from being in the best interests either of the farming community or of the nation as a whole, whilst *in time of war* it constitutes a tremendous handicap which requires not one but many years to fully overcome.

We should never forget that the land is a great heritage and that its rightful use is of the nature of a sacred trust. A peace-time policy which does little or nothing towards encouraging its fullest utilisation is a very short-sighted one, and must inevitably have very serious repercussions.

The outbreak of war on 3rd September 1939 turned the searchlight on some of the weaknesses of the agricultural policy which, save for a few measures of the nature of palliatives, had so long prevailed, and now in feverish haste our efforts are directed towards making up for years of neglect of what should really have been our first and strongest line of defence. We had an army of unemployed and much reclamation and agricultural development work of vital importance awaiting—*e.g.*, the deepening and clearing of watercourses, the drainage of vast areas of water-logged land, the removal of stumps from cut-over woodland that had not been replanted, the clearance of bracken from the better areas on which it had encroached, the rebuilding of dykes and stells on many hill grazings, and other similar work, on which many workers could have been utilised, but we failed to take the steps which would have done so much for the men concerned and for the nation as a whole.

THE PLOUGH THE FIRST LINE OF DEFENCE.

In Scotland we had in 1918 rather more than 2 million acres of land under the plough. This had risen from approximately 1½ million acres in 1914, but by 1939 the tillage area had fallen to less than 1½ million acres and was actually the smallest acreage of land under the plough since records were first taken in 1866. The acreage fell far short of that of the sixties and seventies of last century, the so-called 'Golden Age' for Agriculture.

When the history of the world war comes to be written, that fact alone will furnish adequate proof to succeeding generations that Britain desired not war but peace. Had this not been so the arable acreage would have been very much greater, for it has been definitely established that land under crop is directly or indirectly much more productive of human food than land under grass. This holds true even in the case of good grass utilised for the production of milk ;

hence in our island home with its sea-girt borders *the plough in time of war must constitute our first line of defence*, for by its wider use a much greater proportion of the food-stuffs required can be produced within the confines of the Motherland.

THE EXTENT OF OUR DEPENDENCE ON OVERSEAS SUPPLIES OF FOOD-STUFFS.

In normal times home supplies of milk meet in full liquid milk requirements. This state of matters, though in a sense satisfactory, can scarcely be taken as giving cause for complacency, in view of the fact that the home consumpt of milk per individual, though increasing, is disappointingly small and far below that of many other countries.

In addition to meeting in full liquid milk requirements, home production surplus to these requirements contributes about 9 per cent of our butter and 30 per cent of our cheese supplies. We are therefore largely dependent on imports for our supplies of butter and cheese, and in the past the volume of these imports has been such that they represent a much greater quantity of milk than the home output.

In the case of potatoes and oats, two very important Scottish crops, the former particularly so because of its high food value, we are at normal rates of consumpt very nearly self-supporting and can quite easily become so. We can also provide for a great increase in consumpt of potatoes if that is called for.

For all other food-stuffs—wheat, barley, beef and veal, mutton and lamb, pig meats, cheese and butter, eggs, fruit, vegetables, &c.—we are largely dependent on imports, and in the case of wheat, meat, butter, and cheese these imports are appallingly heavy. It behoves us, therefore, to do our utmost to increase home output, lighten the task of the Navy, and cheat the bomber, the raider, and the submarine of their prey.

THE IMPORTANCE OF MAINTAINING OUR CATTLE AND SHEEP STOCKS.

This country has long been recognised as the stud farm of the world, and whatever steps war conditions may necessitate, the importance of our farm live stock and their contribution to a balanced agriculture should not be underestimated. Even from the point of view of security much could be advanced in support of their retention, for while

we have our flocks and herds we have a potential meat supply.

The need for maintaining our dairy cattle is generally admitted, in view of the importance of the milk supply, and in the rationing scheme recently in force priority was given in the allocation of food-stuffs to cows in milk. There is, however, need for other classes of stock, for the utilisation and conversion into human food of much farm roughage, and for the maintenance of fertility, a factor that may become of vital importance.

It is to be hoped that those in authority will not be unduly influenced by what happened in Germany towards the end of the Great War, when, in the attempt to maintain the cattle population, the animals, owing to lack of feeding, became very emaciated and were practically useless. It would be a great mistake to allow anything of that sort to happen in this country, but if there were any likelihood of it occurring, that would be the time to introduce a slaughter policy. Meanwhile, and right on to near the end of the grazing season, slaughter should be restricted to that necessary to meet immediate human food requirements and the remainder of the stock carried on in order that full benefit might be obtained from the summer grazing and a much greater supply of meat made available for later use.

The plough policy has lessened the area available for grazing, but there is still ample pasture, for there are vast stretches capable of providing quite good keep for store cattle and which would be all the better for being well grazed down. By the transfer of some of the younger stock to such grazings, inbye pasture land not yet ploughed up, and not required for cows in milk, might well be reserved and utilised for the rapid fleshing of the older cattle or for low-ground ewes and lambs. Further, the stock-carrying capacity of grassland can be tremendously increased by manuring and liming, and the degree of increase possible is only now coming to be fully appreciated.

In the case of well bred or quality cattle an average live-weight increase of $2\frac{1}{2}$ -3 lb. per day on grass alone over the grazing season is quite common, and by such a policy the meat supply would be rapidly augmented. If substantial reductions in stock should appear to be called for, other than the removal of the unprofitable or unthrifty animals, the time selected for putting this into operation should surely be towards the end of the grazing season and not at its beginning. The delay would add enormously to the meat supply available, and be highly beneficial in other respects as well. Reliance on crops of direct human value is quite sound policy, up to a point, but prevalence of disease, pest attacks, bad harvests are possibilities that must be

considered. Should such occur a good meat supply would be invaluable.

THE MILK SUPPLY AND THE COW BEST SUITED FOR WAR-TIME CONDITIONS.

In view of the high nutritional value of milk, and its importance as a protective food, the feeding of the dairy cow calls for special consideration. In the past there has been, on the part of many dairy farmers, a tendency to look to the farm to provide for the dairy cow little more than maintenance requirements, these being met from hay or straw as fodder and roots or other succulent food, and to rely for production requirements in very great measure on concentrates, the major proportion of which were imported.

Feeding for high yields has also been common, and in the case of high producers comparatively little of the ordinary farm roughage (straw, hay, &c.) was or could be utilised because of the bulk factor and the capacity of the cow to deal with only a limited amount. We have, in fact, treated high-producing cows as kind of miniature milk factories, and in the running of these factories have not made full use of home produce, but have relied to a very great extent on imports. Many interested in Agriculture have long had grave doubts as to the soundness of such a policy, as it does not make for the same degree of security as when the major part of the food for milk production is produced on the farm. That is so even under peace-time conditions, hence under war conditions there is little that can be advanced in favour of such a policy.

At the other extreme there is the uneconomic producer, for which at no time should there be a place on the farm. If not already disposed of that step should be taken without delay.

The type of cow likely to prove most suitable for war conditions, with restricted amounts of concentrates available, is undoubtedly the moderate yielding cow; the cow that can deal with considerable quantities of bulky foods (grass, hay, straw, roots, silage) and convert these into human food; the cow that when on pasture needs little or no extra feeding during the greater part of the summer and only a moderate amount of concentrates in winter; the cow that is capable of giving a yield of 700 to 800 gallons in a normal lactation. Much can be advanced in favour of such cows, apart from their lower concentrate requirements. They need much less individual attention than the very high yielders, less humouring, less labour, as there is no call for three milkings daily. Further, they are more likely to produce a calf every twelve or

thirteen months, to suffer less from mastitis or other ailments, and have a much longer effective milking life in the dairy herd. It is through such cows that an economic market is found for grass in summer and a considerable proportion of the ordinary farm crops in winter, which, unless utilised in some such way and converted into human food, could not be marketed in a manner calculated to bring an economic return.

Under war conditions, and with greatly restricted imports, the main difficulty likely to arise in the feeding of the dairy cow is in connection with the protein supply, so important in milk production. In the past we have had abundance of protein-rich concentrates, and in many cases there has been a tendency to feed an over-generous allowance which may actually have had an adverse effect.

In early summer good pasture generally supplies more than sufficient protein for a moderate milking cow—*e.g.*, a medium-sized cow consuming daily 140 lb. of fairly good pasture would get therein nutrients sufficient for body maintenance and for the production of 4 gallons of milk, 3·8 per cent butter-fat. Indeed, the protein content of the grass would be sufficient for almost another gallon of milk. The feeding is accordingly wasteful of protein, unless the cow is capable of giving 5 gallons, in which case the grazing should be supplemented not with dairy cake but with a little carbohydrate food such as crushed oats or flaked maize.

As the season advances the grass, unless liberally manured and rotationally grazed, is not of the same high feeding value, and in the case of high producers supplementary feeding generally becomes necessary.

In winter, with hay, straw, and roots constituting the basal ration, extra feeding is essential for cows in full milk. Beans, where grown, or mashlum, are very valuable as a source of protein. Beans, however, have the drawback that they are late in ripening and are apt to constitute a somewhat precarious crop in many parts of Scotland. Not only so, but a very great increase in the acreage under this crop would be required to affect materially the protein supply.

The simplest way of securing a greater measure of self-sufficiency would seem to be in the making and utilisation of high quality grass silage, for grass ensiled at the right stage is just as valuable in winter as good grass is in summer.

SILAGE *v.* CONCENTRATES FOR MILK.

An experiment carried out at Auchincruive during the latter part of the winter would seem to indicate that cows on a basal ration of hay and roots for '*maintenance*,' with

good silage as a *production* ration, will maintain their body condition and milk just as well as cows getting the same basal ration and a normal allowance of concentrates per gallon of milk produced.

In the experiment under consideration eight cows were utilised, four of these being Ayrshires and four British Friesians. The cows were at different stages in their lactation, some having been in milk for several months whilst others were only comparatively recently calved. The cows were arranged in two groups of four, Group A. and Group B., with two Ayrshire cows and two British Friesian cows in each group.

The feeding trial was conducted on what is known as the reversal method, in order that a fairly speedy indication of the relative efficiency of the two rations might be obtained. The reversal method has also the advantage that it practically rules out any differences in yield due to the individuality of the animals comprising the experimental groups.

The maintenance ration fed to all the cows consisted of 40 lb. roots (swedes and, later, mangels) and 16 lb. hay, and was a little on the generous side.

In the case of Group A., the four cows were given silage in place of concentrates for a period of fifteen days. The silage was then replaced with concentrates for the next fifteen-day period, and in the final fifteen days the feeding was the same as in the first period.

The cows in Group B. were dealt with in a similar manner, excepting that concentrates were fed during the first fifteen days and were replaced with silage in the second period of fifteen days, the feeding in the final period being the same as in the first period.

It is well known that a food-stuff might still exert some influence on productivity, composition, or flavour of milk for several days after the feeding of it had been discontinued, and to eliminate any such effect the first five days' results in each period were disregarded and the results measured by the yield over the remaining ten days in the period.

The concentrate mixture used in the trial consisted of—

- 3 parts crushed oats ;
- 3 parts mashlum meal (oats and beans) ;
- 2 parts soya bean meal ;
- 2 parts bran.

This mixture was fed at the rate of $3\frac{1}{2}$ lb. per gallon of milk produced.

The silage which replaced the concentrates had been made in a 'Sisalkraft' silo ; the crop ensiled was first-cut seeds, taken just a little before the shooting stage was reached, except in the case of a few of the earlier grasses which were emerging into ear.

The analysis of the resulting silage when fed showed it to contain 21·92 per cent dry matter and 3·6 per cent crude protein. The pH value of the silage was 3·98, which indicated that the fermentation had been on right lines. When stated on the basis of 90 per cent dry matter the silage contained 16·1 per cent crude protein.

It was decided to feed the silage at the rate of 5 lb. of silage to 1 lb. of concentrates, as, when allowance is made for digestibility, amount of moisture present in the silage, &c., these quantities were closely comparable, except as regards bulk.

The production ration per gallon of milk in the case of the silage group was 17½ lb., and in the case of the concentrate group 3½ lb. It will be observed that one ration was entirely home-produced and consisted of the bulky foods of the farm—silage, hay, and roots.

Feeding was strictly in keeping with production, and the amount varied according to the milk yield. In the case of silage the actual quantity fed averaged 51·8 lb. per cow over the period of the trial, but it ranged from 35 lb. to 81 lb. in keeping with the yield of milk. The concentrates consumed averaged 10½ lb. per cow per day for the duration of the trial.

As regards the influence of the silage and concentrates on the yield and quality of milk obtained, taking first Group A. and averaging the yields from the silage ration in the first and third periods, the average daily yield from the four cows was 3·45 gallons of milk per cow, containing 1·35 lb. butter-fat, whilst that from the same animals in the middle period when getting concentrates was 3·7 gallons containing 1·22 lb. butter-fat. The concentrates therefore gave a little more milk but rather less butter. In the case of Group B., and which included cows which had been in milk for several months, the average daily yield from the four cows when getting concentrates in the first and third periods was 2·55 gallons per cow, containing ·90 lb. butter-fat, and in the middle period when getting silage 2·48 gallons containing ·82 lb. butter-fat.

When the daily averages for the two groups and all the periods are taken there is very little between them. *The cows when getting silage gave an average daily yield per cow of 2·96 gallons of milk, containing 1·09 lb. butter-fat, and when getting concentrates 3·1 gallons, containing 1·08 lb. butter-fat.*

All of the cows remained in excellent bloom and condition throughout the entire feeding period and did not seem to fail in any respect whatever. General opinion was to the effect that, if anything, they improved in condition.

Some of the smaller animals when on the silage ration were not able to clear up entirely their fodder allowance and left from 3 to 4 lb. of hay. This was doubtless due to the

and twelfth weeks, and averaging $7\frac{1}{2}$ lb. daily over the feeding period.

The commencing daily allowance of swedes was 54 lb., and this was increased to 60 lb. at the beginning of the fifth week and to 66 lb. at the beginning of the ninth week, the average over the twelve-week feeding period being 60 lb.

The fodder allowance was 16 lb. daily (8 lb. hay and 8 lb. straw).

The concentrate mixture consisted of—

- 4 parts crushed oats ;
- 4 parts flaked maize ;
- 2 parts decorticated ground nut cake ;
- 1 part linseed cake.

In previous trials the control ration indicated had generally given a live-weight increase in the neighbourhood of $2\frac{1}{2}$ lb. per bullock per day over the feeding period, and the response was again very similar to that of previous years, being 2.6 lb. per bullock per day.

A group of eight cattle received the same allowance of roots and fodder, but no concentrates, these being entirely replaced with silage. The silage being from a crop approaching the hay stage, and on that account not likely to be quite equal to that made earlier in the year, was fed at the rate of 6 lb. silage to 1 lb. of concentrates, and increased in like proportion.

The commencing allowance was 36 lb. daily, and this rose to 51 lb. in the eleventh and twelfth weeks of the trial, the daily average allowance of silage over the entire feeding period being $43\frac{1}{2}$ lb. per bullock as against $7\frac{1}{2}$ lb. concentrates.

It was again noted that the cattle getting silage, like those in the experiments already dealt with, were not able to consume the full allowance of fodder, some of the straw in particular being generally left.

The silage was of very good quality, with the result that the cattle took readily to it and after a few days were consuming the full allowance.

As regards the progress made on the silage ration, this was not quite up to that normally obtained from a ration containing a moderate amount of concentrates, the live-weight increase of the cattle in the silage group being $1\frac{1}{2}$ lb. daily and considerably behind that of the control group.

The animals constituting the control group were a little heavier at the commencement of the trial and perhaps, on the whole, of slightly better type than those in the silage group. These are factors which might account for part of the difference in rate of live-weight increase, nevertheless the main factor in difference in rate of progress was undoubtedly the superiority of the concentrate ration over the silage ration.

The average live weights of the cattle comprising the control and silage groups at the beginning and end of the twelve-week feeding period and their average daily live-weight increases were as follows :—

Ration	Average Live Weight at						Average Live-weight Increase			Average Daily Live-weight Increase
	Start.			Finish						
	cwt	qr	lb	cwt	qr	lb	cwt	qr.	lb	lb
Control . . .	8	3	25	10	3	21	1	3	24	2.6
Silage in place of concentrates .	8	2	7	9	2	21	1	0	14	1.5

On the day on which the twelve-week feeding period terminated the cattle were sent to Ayr for grading, and were slaughtered on the following day. The grading of the bullocks in the two groups was as follows :—

Control group—6 cattle : all Grade A.

Silage group—8 cattle : 3 Grade A. ; 2 Grade A. — ;
1 Grade B. + ; 2 Grade B.

When the cattle were slaughtered the average carcass weight of the animals in the control group was 671½ lb. and that of the cattle in the silage group 590½ lb., a difference of 81 lb. Allowance must, of course, be made for the fact that the cattle in the silage group were actually 46 lb. lighter than those in the control group at the start of the trial. When due allowance is made for this and for the number of silage-fed cattle that qualified for Grade A., it will be readily apparent that the silage has given quite a good result though it did not prove equal to the control ration.

On the conclusion of this trial, a second one was undertaken with cattle which had been bought at the October sale already referred to, but which had been outwintered until January. The experiment was on similar lines to the previous one, the only difference being that in view of the rather lower initial live weight of the cattle the commencing allowance of concentrates was 5½ lb. instead of 6 lb., and the allowance of silage 33 lb. instead of 36 lb.

The concentrates were increased gradually to a maximum of 8 lb. in the eleventh and twelfth weeks, and thus averaged 6½ lb. daily over the feeding period. The silage was increased to 48 lb. in the eleventh and twelfth weeks, and averaged 40½ lb. daily over the feeding period.

The average live weight of the cattle at the commencement

of the trial, the average total increase, and the daily live-weight increases were as undernoted :—

Ration.	Average Live Weight at						Average Live-weight Increase.	Average Daily Live-weight Increase.		
	Start.			Finish.						
Control	cwt.	qr.	lb.	cwt.	qr.	lb.	cwt.	qr.	lb.	lb.
	7	1	16	9	0	16	1	3	0	2.3
Silage replacing concentrates .	7	1	2	8	1	23	1	0	21	1.6

The cattle were sold on the conclusion of the feeding trial and the grading was as follows :—

Control group—6 bullocks : 1 A. + ; 1 A. ; 4 A. —.

Silage group—8 bullocks : 1 A. + ; 2 A. ; 2 B. + ; 1 B. ; 2 B. —.

Although the results of these feeding trials indicate that with the rations used, and which contained 60 lb. of roots, concentrates are superior to silage for winter beef production, nevertheless the result from silage shows that it can be relied on to give quite a good result in beef production.

PREDIGESTED STRAW *v.* UNTREATED STRAW FOR BEEF PRODUCTION.

In this trial cut straw was treated with a weak solution of caustic soda to make it more digestible and thereby raise its nutritional value. Straw which had previously been cut into short lengths was steeped in a 1½ per cent solution of caustic soda for a period of twenty-four hours in a large concrete tank, the cut straw being pressed down into the caustic soda solution until completely immersed. Thereafter the caustic soda was run into an adjoining tank and the straw sprayed with water to wash out any caustic soda that remained.

The resulting material, which in appearance was very much like silage, was then ready to feed to the stock.

There would appear to be a loss of about 20 per cent of the total dry matter of the straw as the result of the treatment, hence if the process is to prove an economic one the remainder of the straw would need to be greatly enhanced in feeding value.

The main object of the treatment is to break down the lignified outer surface and render the straw, the carbohydrate content of which is mainly in the form of cellulose, more easily digested. The treatment has an adverse effect on the protein, but, in view of the small amount present in straw, that is of

little importance. Predigested straw, because of its low protein content, is likely to be much more valuable for beef than for milk production.

The process was fully outlined by Professor Scott Watson in the 'Transactions' of the Highland and Agricultural Society for last year, and readers are referred thereto for fuller particulars.

A preliminary experiment was undertaken by the College at the request of the Department of Agriculture for Scotland in the summer of 1940, and two further trials were carried out during last winter. The predigested straw investigations that have been carried out were made possible by the aid of a special grant for equipment from the Agricultural Research Council, and this opportunity is taken of expressing the indebtedness of the College to the Council for its interest in the investigation and for the financial assistance given. The summer trial was undertaken in order that some information as to the benefit from predigesting the straw might be available before the winter fattening started.

In the 1940 summer trial already referred to, twelve recently imported Irish bullocks were selected from a group of fourteen purchased in Lanark in the month of June. The twelve selected animals were arranged in two groups of six, as nearly as possible alike in all respects, and in this trial they were actually housed and fed singly instead of in pairs, which in the past had been the method commonly adopted at Auchincruive.

The animals comprising the two groups were treated alike in all respects excepting that those in Group I. received untreated straw and those in Group II. the residue from the same amount of straw after being cut into short lengths and steeped in weak caustic soda solution.

The ration fed to both groups consisted of—

16 lb. straw ;
40 lb. mangels ;
6 lb. concentrates.

In the predigested straw ration it was, of course, the residue from 16 lb. straw after treatment that was fed.

The concentrate mixture differed somewhat from the one already referred to as having been used in many feeding trials, and consisted of—

4 parts crushed oats ;
2 parts decorticated earth nut meal ;
1 part linseed cake meal.

To bring conditions more into line with normal feeding practice mangels were fed. Owing, however, to the supply being inadequate for an eighty-four day experiment, this had to be curtailed to a sixty-day trial.

The cattle took fairly readily to the treated straw, and almost from the outset they cleared up the entire allowance. They seemed to relish the predigested straw very much more than the untreated straw, which was by no means appetising, being dry and unpalatable and not readily eaten.

The feeding trial commenced on 27th June and was continued until 26th August. Being of short duration, too great stress should accordingly not be put on the results obtained, though they are undoubtedly very suggestive.

The average live weights of the cattle in each of the two groups at the start and finish of the sixty-day feeding trial, and the total and average daily increases, were as follows :—

Ration	Average Live Weight at						Average Live-weight Increase			Average Daily Live-weight Increase
	Start			Finish						
	cwt	qr	lb	cwt	qr	lb	cwt	qr	lb	lb
Control, untreated straw	7	3	9	8	2	26	0	3	17	1 7
Predigested straw	7	3	14	9	0	14	1	1	0	2 33

The foregoing short period summer trial, though carried out under rather exceptional conditions, nevertheless seemed to indicate that the nutritional value of straw fed to stock in summer was materially improved by the caustic soda treatment and the straw rendered much more palatable. As was to be expected, the untreated straw, being dry and unpalatable, was not well eaten by the cattle, and for that reason, though the results are very promising, too much stress should not be put on them until confirmed by further trials carried out under more normal conditions.

The second experiment with predigested straw was carried out during the first part of the winter of 1940-41. It commenced on the 22nd October and was continued for a period of twelve weeks, finishing on the 14th January. The cattle used in the trial were from the group of sixty purchased a few days previously.

The control group in the silage investigation already reviewed served also as the control in the predigested straw trial. The control ration has already been given ; it consisted of a daily average over the feeding period of $7\frac{1}{4}$ lb. concentrates, 60 lb. swedes, 8 lb. hay, and 8 lb. straw.

The predigested straw group received a like ration, excepting that the straw was steeped in caustic soda solution for a period of twenty-four hours as in the summer experiment ; thereafter the soda solution was run into an adjoining tank, and the treated straw washed with water to remove any caustic soda before the straw was fed to the cattle.

In this trial, as in the first one, the cattle took very readily to the predigested straw and were soon clearing up their full allowance.

As already pointed out, the treatment causes a loss in dry matter generally in the neighbourhood of 20 per cent. The total dry-matter content of the 8 lb. of straw after treatment was accordingly considerably less than in the case of the untreated straw.

It should be noted that the amount of straw in the ration was very much less than in the summer experiment, being 8 lb. as against 16 lb., but if the treatment raises the starch equivalent value of the straw from 17 per cent to 50 per cent, as it is claimed to do, the predigesting of 8 lb. should provide additional starch equivalent sufficient for the production of an extra $\frac{1}{2}$ lb. live-weight increase daily. The 8 lb. predigested straw would not exceed the equivalent of $6\frac{1}{2}$ lb. after treatment, but at 50 per cent starch equivalent $6\frac{1}{2}$ lb. straw would supply 3.25 lb. S.E., whilst 8 lb. untreated straw would only supply 1.36 lb., a difference of 1.89 lb. S.E., which would be ample for an extra $\frac{1}{2}$ lb. live-weight increase daily.

The actual results were as follows :—

Ration	Average Live Weight at						Total Live weight Increase			Average Daily Live-weight Increase
	Start			Finish						
	cwt	qr	lb	cwt	qr	lb	cwt	qr	lb	lb
Control	8	3	25	10	3	21	1	3	24	2.6
Predigested straw	8	2	9	10	1	9	1	3	0	2.3

The cattle were sent to Ayr Market and were graded on the day the experiment finished. The actual grading of the animals comprising these two groups was as follows :—

Control group—6 cattle : all Grade A.

Predigested straw group—8 cattle : 5 Grade A. ;
1 Grade A. — ; 2 Grade B. +.

It would therefore appear from the grading that the control group were rather better finished than the predigested straw group.

As measured by live-weight increase, there was in this trial no benefit from the predigesting of the straw, nor was there any increase in carcass weight, that of the control group being 671 $\frac{1}{2}$ lb. per bullock and that for the predigested straw group 642 lb., a difference of 29 $\frac{1}{2}$ lb. In this connection attention is called to the fact that the control group were

actually 44 lb. heavier than the predigested straw group at the commencement of the trial. There was little difference in the percentage carcass weight to unfasted live weight of the two groups, these being 55.8 per cent for the control and 55.4 per cent for the predigested straw group. These percentages are, of course, relative to unfasted live weight and based on the actual live weight of the cattle just before transport to market. A deduction of $\frac{1}{4}$ cwt. per animal would raise the percentage carcass weight to unfasted live weight to between 58 and 59 per cent.

There are at least three factors that might account for the somewhat disappointing result from the predigested straw in the trial under consideration as compared with that obtained in the summer experiment.

The straw was from an oat crop recently harvested under very favourable weather conditions, and even in the untreated state was nutritious, palatable, and readily consumed during the entire period of the experiment. In the summer experiment the untreated straw was not readily eaten.

The more generous root ration, as compared with the quantity fed in the summer experiment, may have rather taken away from the benefit from predigesting the straw.

As already pointed out in connection with the silage trial, the control group were a little heavier and also seemed to be on the whole of rather better type than those comprising the other group. An average daily increase of 2.6 lb. per day for the control group was exceptionally good, and though the starch equivalent of the predigested straw ration was value for the production of an additional $\frac{1}{4}$ lb. daily, the cattle were probably not capable of responding to that extent.

A third trial, which has only just finished, was carried out with predigested straw. It was on similar lines to the preceding one, excepting that the commencing allowance of concentrates was $5\frac{1}{2}$ lb. instead of 6 lb. The cattle used in the trial had been outwintered, and their average live weight was rather lower than that of those in the previous trial.

The experiment, which was of twelve weeks' duration, commenced on 30th January and finished on the 24th April. The relative particulars are as follows :—

Ration.	Average Live Weight at						Average Live-weight Increase.			Average Daily Live-weight Increase.
	Start.			Finish.						
	cwt.	qr.	lb.	cwt.	qr.	lb.	cwt.	qr.	lb.	lb.
Control	7	1	16	9	0	16	1	3	0	2.3
Predigested straw	7	1	2	9	1	3	2	0	1	2.7

In this trial, as in the summer trial, the ration containing the predigested straw was definitely superior to the control ration with untreated straw and the response much in keeping with that expected from the higher starch equivalent value of the treated straw.

The cattle were marketed on the conclusion of the trial and the grading was as follows :—

Control group—6 cattle : 1 A. + ; 1 A. ; 4 A. —.

Predigested straw group—8 cattle : 2 A. + ; 2 A. ; 2 B. + ; 2 B.

The average carcass weight of the control group was 572½ lb. and of the predigested straw group 578 lb. Relative to unfasted live weight, the carcass percentage for the control group was 55·8 per cent and for the predigested straw group 55·6 per cent.

The question naturally arises as to why a definite response should have been obtained in the first and third trials from the predigesting of the straw and a negative result in the second. The writer is strongly of the opinion that whilst all of the factors previously referred to may have had some effect, the period at which the straw is fed is almost certain to have a marked influence on the result. During the period October to early in January the straw is nutritious, palatable, and readily eaten. In the late winter and early spring it is less palatable, and as the season advances it becomes very dry and still less palatable.

In the summer experiment the untreated straw fed was very dry, unpalatable, and not at all readily eaten, and that may help to explain why the same result was not obtained from the treatment of the fresh straw used in the second experiment, but this is an aspect of the matter which would seem to call for further consideration and investigation.

In view of the somewhat conflicting results obtained, the only claim that can be made at present is that in the case of straw to be fed in late winter and spring and summer the caustic soda treatment effects material improvement in its feeding value.

It should be noted that oat straw was used in all of the trials that have been dealt with. It is possible that a different result might be obtained from the treatment of barley or wheat straw, which are much less nutritious than oat straw.

Cost of Treatment.—The cost of treatment given below is based on the cost for the experiment just concluded and which extended from January to the end of April. In the statement no allowance has been made for depreciation of

equipment or other overhead expenses. The details are as follows :—

(a) To chaffing 2½ tons of oat straw by silage cutter—			
2 tractor hours at 3s. per hour . . .	£0	6	0
6 man hours at 1s. 3d.	0	7	6
Erecting and dismantling silage cutter:			
1 man hour, 1s. 3d.	0	1	3
	<hr/>		
			£0 14 9
(b) To cost of caustic soda used, 4½ cwt. at			
22s. 3d. per cwt.	£5	5	8
Washing water: 18,000 gallons at 1s. 3d.			
per 1000 gallons	1	2	6
	<hr/>		
			6 8 2
(c) Labour in filling the tank, siphoning soda solution,			
standardising, washing of straw: 14 man hours			
at 1s. 3d.		0	17 6
			<hr/>
			£8 0 5

It will be observed that the additional costs per bullock for the predigested straw group as compared with the control group are almost exactly £1 per animal (£8, 0s. 5d. for 8 cattle). The additional cost is therefore 3d. per bullock per day or £1 for the 84-day feeding period.

The initial quantity of caustic soda used was 30 lb. per 200 gallons of water, thus giving a 1½ per cent solution. For each 192 lb. of cut straw, 18 lb. additional caustic soda was added. This quantity of straw was sufficient for three days' feeding, so that the tanks required to be filled on twenty-eight separate occasions.

It should be pointed out that on many farms there would be no additional charge for water for spraying the straw after the caustic soda solution had been drawn off.

Unless the cost of predigesting straw can be substantially reduced, there does not seem to be much hope for its adoption for stock feeding unless as a war measure.

SHEEP FEEDING.

High versus Low Protein Concentrate Ration.—In view of the shortage of feeding-stuffs and the importance of reserving protein-rich concentrates for milk production, a sheep-feeding experiment was carried out to ascertain how progress was affected by a reduction of protein in the concentrate mixture.

Two groups of cross hoggets with thirty in each group were treated exactly alike in all respects, excepting that for one group the protein content of the concentrates fed was

much lower than that of the other. For the one group the concentrate mixture consisted of equal parts crushed oats, flaked maize, dried grains, and decorticated cotton seed meal, and for the other group crushed oats, flaked maize, and dried grains.

The quantity fed was the same in both cases. The allowance commenced at $\frac{3}{4}$ lb. daily and was increased by 1 oz. each week over a nine-weeks period, rising to $1\frac{1}{4}$ lb. and averaging 1 lb. daily over the feeding period.

The average live weight of the thirty hoggets in the high protein group was at the commencement of the trial 75.2 lb. and that of the low protein group 74.7 lb. The live-weight increase for the two groups over the nine-week feeding period was for the high protein group 16.2 lb. per sheep, and for the low protein group 16.7 lb. The high protein group gave a slightly higher carcass weight, this being 49.7 lb. as against 48.9 lb.

The result of the trial would seem to indicate that for sheep being fattened in a relatively short feeding period, a low protein concentrate ration will suffice. This finding confirms the result of previous experiments carried out by the College.

INFLUENCE OF BREED ON RETURN OBTAINED.

The next investigation now briefly reviewed was undertaken to ascertain the relative returns likely to accrue from the fattening of some of the pure breeds and cross breeds of sheep, and in particular to see how, when the amount of food consumed was taken into account, the return from the smaller hill breeds compared with that from the larger low ground breeds.

In the investigation 200 sheep were utilised. These consisted of five groups with forty sheep in each group. The breeds and crosses represented were as follows :—

- The Blackface ;
- The Cheviot ;
- The Cross (Border Leicester ram and Blackface ewe) ;
- The Suffolk Cross (Suffolk ram and Cross ewe) ;
- The Half-Bred (Border Leicester ram and Cheviot ewe).

With the exception of the Half-Bred lambs, which had been bred and reared on the farm at Auchincruive and were out of south-country Cheviot ewes bought in the previous autumn, all of the lambs were purchased in the end of August or early in September. The purchase prices for the different lots

and the costs per lb. live weight at the time of purchase were as follows :—

Breed or Cross	Purchase Price.	Live Weight.	Cost per lb. Live Weight.
Blackface	16/6	53.5 lb.	3.7d.
Cheviot	20/9	54.8 lb.	4.5d.
Cross	42/-	76.6 lb.	6.6d.
Suffolk Cross	44/6	77.4 lb.	6.8d.
	Estimated Value.		Value per lb.
Half-Bred (reared on the farm) .	52/6	91.1 lb.	7d.

The Half-Breds were in rather better condition than the others, and the price assigned was accordingly put slightly above the purchase price per lb. of the Cross and Suffolk Cross lambs. In the open market they would have brought at least 52s. 6d. each.

The sheep were not put on aftermath, but were run on medium quality grass from the time of purchase until transferred to the root break later in the year.

During the period the sheep were on grass they were given no supplementary feeding, and when transferred to the root break were not even accustomed to trough feeding. They were weighed before the commencement of the trial, but had made relatively little progress whilst on the grass; it was felt, however, that if the sheep were too liberally fed before going on to the roots they would not respond so readily when on the root break.

The average live weights of the sheep comprising the respective groups at the commencement of the trial were as follows :—

Breed or Cross.	Live Weight.	Increase while on Grass.
Blackface	57.6 lb.	4.1 lb.
Cheviot	58.6 lb.	3.8 lb.
Cross	81.6 lb.	5 lb.
Suffolk Cross	80.8 lb.	3.4 lb.
Half-Bred	96.4 lb.	5.3 lb.

A certain amount of lameness amongst the Suffolk Crosses may have been responsible for their rather lower live-weight increase during the period on grass.

The feeding period was of nine weeks' duration, as previous experiments had shown that sheep in moderate condition could be fattened on roots and concentrates in a period of nine weeks, and that to unduly prolong the fattening period lessened the number of sheep that could be fattened per acre of roots.

The rations fed were as nearly as possible in keeping with the live-weight requirements of the sheep, and in that connection it should be noted that smaller sheep require relatively a little more for maintenance than larger sheep.

The daily allowance of concentrates was increased at the end of three weeks and again at the end of six weeks. The root allowance was increased in like manner.

The average daily rations consumed over the nine-week period by the different breeds and crosses were as follows :—

Blackface and Cheviot	.	.	{	Cut swedes, 10 lb.
			{	Concentrates, $\frac{1}{2}$ lb.
			{	Hay, $\frac{1}{2}$ lb.
Cross and Suffolk Cross	.	.	{	Cut swedes, 14 lb.
			{	Concentrates, 1 lb.
			{	Hay, $\frac{1}{2}$ lb.
Half-Bred	.	.	{	Cut swedes, 15 lb.
			{	Concentrates, $1\frac{1}{2}$ lb.
			{	Hay, $\frac{1}{2}$ lb.

The concentrate ration fed was readily consumed ; it consisted of a mixture of :—

- 4 parts crushed oats ;
- 2 parts dried grains ;
- 1 part dried grass meal ;
- 1 part decorticated cotton seed meal.

The dried grass meal was in a very fine condition, and in windy weather was apt to be blown away. In moist weather it tends to become unpalatable and scrupulous cleanliness of the troughs is necessary. Clean dry troughs for the concentrates is always a factor of importance in rapid fattening.

The Suffolks seemed to settle most quickly to the folding condition and took readily to trough feeding, being on the whole the best root feeders. The Cheviots, on the other hand, retained their roving disposition and were the slowest to settle to trough feeding.

The amount of dry matter in the rations consumed by the different groups at the beginning and end of the feeding period on the basis of 100 lb. live weight was as follows :—

DRY-MATTER CONSUMPTION PER 100 LB. LIVE WEIGHT.

Breed or Cross.	At Commencement.	At Finish.
Cheviot and Blackface	. 3.0 per cent	3.08 per cent
Cross and Suffolk Cross	. 2.91 "	2.9 "
Half-Bred	. 2.8 "	2.74 "

It will be observed from the foregoing figures that the smaller sheep consumed relatively a little more than the larger sheep.

On the day on which the experiment terminated, all of the sheep in the experimental groups were sent to Ayr to be graded, and all were placed in the first grade with the exception of four of the Blackface group. The graded carcass weights

for the different groups, the price per lb., the price per sheep, and the margin over the purchase price were as undernoted :—

Breed or Cross.	Estimated Carcass Weight.	Grade Price per lb.	Average Price per Sheep.	Margin over Inbuying Price.
Blackface . . .	{ 31½ lb. for 36 26 lb. for 4	{ 1/4½ } 10½d. }	40/9	23/3
Cheviot . . .	34 lb.	1/4½	46/—	25/3
Cross . . .	49 lb.	1/4½	66/4	24/4
Suffolk Cross . .	52 lb.	1/4½	70/5	25/7
Half-Bred . . .	58 lb.	1/4½	78/2½	25/8½

It will be observed that when the inbuying price is deducted from the amount realised, there is very little difference in the margin per sheep for the different groups despite the great difference in size of sheep and in food consumed during the fattening period.

The actual amount of food consumed by each group of forty sheep was as follows :—

Blackface and Cheviot . . .	{ Swedes, 11 tons, 5 cwt. Concentrates, 16½ cwt. Hay, 5½ cwt.
Cross and Suffolk Cross . . .	{ Swedes, 15 tons, 15 cwt. Concentrates, 22½ cwt. Hay, 7½ cwt.
Half-Bred	{ Swedes, 16 tons, 17½ cwt. Concentrates, 28½ cwt. Hay, 7½ cwt.

When due allowance is made for the food consumed by the different breeds and crosses, it will be readily apparent that the small breeds have given very much the better return, as three small sheep consumed no more than two of the larger sheep. Further, with the smaller sheep a very much larger number can be fattened per acre and a greater return obtained per ton of swedes consumed.

After allowing for grazing costs, labour of tending and feeding, dipping, the value of the hay and concentrates consumed, and deducting the total cost of these items from the return obtained, the actual return per ton of swedes consumed by the different breeds and crosses is as follows :—

Blackface	56/— per ton.
Cheviot	63/3 „
Cross	37/8 „
Suffolk Cross	41/- „
Half-Bred	34/7 „

The foregoing trial would seem to indicate that when inbuying prices are similar to those that prevailed last autumn, smaller sheep are likely to give a much greater return per ton of turnips consumed than bigger sheep, and in view of the larger number of smaller sheep that can be fattened per acre, they are likely to leave a greater margin for profit.

ENSILAGE.

By A. S. B. WILSON, B.Sc., Boghall Experimental Farm, Edinburgh.

ENSILAGE is the process of conserving certain classes of green fodder in a succulent condition suitable for stock feeding throughout the winter months or at such times as fresh fodder is not available. The normal curing treatment of fodder crops (hay, cereals, clovers, &c.) consists of drying the surplus moisture to a stage when it is judged safe to store the material in bulk without risk of wastage and deterioration. Ensilage on the other hand embodies the conservation of the 'sap' as well as the basic dry matter of the material.

Silage making has had a powerful stimulus since the advent of war. During the 1940 season propaganda by the Ministry of Agriculture exhorted farmers in the United Kingdom to produce one million tons of silage so as to reduce the need for valuable shipping space. Silage officers were appointed by several of the English Agricultural Committees, and technical advisors from the Agricultural Colleges attended to the needs of Scottish farmers. Many farmers were fortunate in producing silage of high quality, free from wastage, but on the other hand there were many who, through lack of previous experience and a proper knowledge of the process, were disappointed and disillusioned with their first efforts.

At this stage it may be of interest, particularly to Border farmers and land-owners, to recall the initiative shown by the Highland and Agricultural Society in the process of silage making when, in 1883, they sponsored the first 'official' test of the process in Scotland, at the farms of Harcus and Earlypier, in Eddleston water, Peeblesshire. An account of these trials was recorded in the 'Transactions' of 1884, and an article written by Dr A. P. Aitken, the Society's Chemist at that time, described the process of silage making. The description of the basic principles and biochemical processes involved, although written almost sixty years ago, proves once more that "there is nothing new under the sun."

PRINCIPLES OF SILAGE MAKING.

Let it be stressed at the beginning that no matter how well silage is made, even should molasses or mineral acids

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be added to assist the process, some loss is inevitable between the quantity of digestible material filled into the silo and the quantity of digestible material taken out of the silo. Ensilage will not enhance the feeding value of the material to be ensiled. Loss of dry matter appears to be inevitable when fodder crops are conserved for later use, and it is now known that, of all curing processes, artificial drying of grass or other fodder crops is least wasteful in this respect, and hay-making, under average conditions, most wasteful. Ensilage will take a place between these two processes.



Fig. 1.—*The Hareus silo where the first official tests of the process were made by the Highland and Agricultural Society in 1884.*

Photograph taken at Hareus, Eddleston, Peeblesshire

The following dry-matter percentages approximate to the loss which can be expected when grass is conserved in the following ways :—

	Per cent
Artificially dried in a grass drier	5
Ensiled in silos	5-15
Made into hay	10-20

Ensilage, if properly made, has therefore an efficiency level over haymaking in the conservation of food units from a given weight of green fodder. This does not infer, however, that haymaking as we now know it should be scrapped. Fresh green fodder, whether it be grass, cereal, or clover, begins to heat when filled into a silo. Why should this be ?

Firstly, when green material is cut, the living cells which make up the structure of the plant live on, and continue to respire as long as conditions of air, moisture content, and temperature are suitable. This respiratory process, involving, as it does, cellular breakdown, liberates carbon dioxide gas, water, and energy in the form of heat. Such a change, naturally, involves some sacrifice of carbohydrate material. As any respiratory process implies oxidation, it follows that exclusion of air will, in the end, influence the amount of heat generated. The methods usually employed to exclude air when making silage will be dealt with later in this article.

The full part that plant enzymes play in the production of silage is not known. Enzymes, however, are able to influence the breakdown of complex proteins into simpler forms, even after the plant cells are dead. Whether this simplification has any digestive advantages is not completely known. The part played by bacteria and fungi in the formation of the final silage product is, however, now better understood; in fact, control of the conditions affecting the growth of the different bacterial populations found naturally on all fresh herbage will influence to a major extent the quality of the final product. The best quality silage is produced when lactic acid is formed rapidly and in excess of all other organic acids. As the formation of organic acids is a 'cumulative' process, it is desirable to reach an acidity level of around pH 4 as rapidly as possible, for at this level the bacterial flora, able to produce the organic acids of a more volatile nature (butyric, acetic, and propionic), are largely eliminated. A lactic dominant fermentation, producing what is described as 'sweet' silage, is also achieved if the fermentive temperature rises above 120° F. At this stage the lactic-forming bacteria become dominant, with the formation of 'sweet'-smelling silage. This rise in temperature, however, has the disadvantage of being wasteful of dry matter and harmful to the digestibility of the proteins originally present. A rise in the fermentation temperature is to a great extent influenced by the amount of air or oxygen in the silage. No hard and fast rules can be laid down as to the degree of compaction necessary to produce the best silage, as so much depends on the character and composition of the fodder to be ensiled. It may be taken as a rough guide, however, that except for extremely succulent grass with a relatively high protein starch ratio, or damp material which conceivably could be compacted so tight that air was almost entirely excluded, it will be necessary to achieve as much consolidation as possible, either by trampling in the case of the cylindrical silos, or, in pit silos, by running a horse and cart over the material after filling. Much useless energy is expended when trampling inside cylindrical silos. The main source of wastage, or the position where friction prevents

a proper settling of the material, is obviously at the sides, and it is here that the consolidation must be most thorough. Consolidation will be easily achieved in the centre by keeping this part well filled up; in fact, all cylindrical silos should be built cone-shaped, so that when filling is completed a dome is left which thatched or covered will also act as a roof to 'shed' rain. If silage fodders are not thoroughly compacted, fermentation temperatures will reach a level where 'sweet' silage is formed. This material is dark brown or even black in colour, and in the case of very rough material may be ruined by pockets of mould growth. If, therefore, the amount of air in the silo is controlled by adequate consolidation, mould growth is also controlled. A certain amount of mould waste always occurs in the top four to six inches of any silo. In that event the logical method of controlling this inevitable wastage is to complete the silo with material which has little or no value. Hayrick bottoms or waste straw from potato pits often fill the bill for this purpose. Certain anti-mould preparations, some based on mustard oil or carbolic acid, can be applied to 'seal' off the silo, but none have been shown to be so completely efficient as to justify their universal use. In the case of a crop of oats, tares, and beans, grown specially for silage purposes, adequate consolidation cannot be achieved unless it is first chopped, in view of the 'stemmy' nature of the material. If filled into the silo in a 'long' condition, fermentation temperature will inevitably rise to a pitch where considerable wastage occurs. The only possible method of treating long material on farms without chopping facilities is to produce such silage in pits. It is usually possible to achieve proper compaction by using the 'heavy' horse and cart to obtain thorough consolidation.

In the case of young grassy material or damp fodder, where possibly compaction is so easy as to lead to the exclusion of almost all air, fermentation temperatures may be so low that undesirable fermentations not based on lactic acid are formed. The most undesirable form of anaerobic fermentation is that in which butyric acid, also produced when butter goes rancid, is predominant. Should this stage be reached, the silage may have to be 'written off' on account of its unpalatability. In low-temperature fermentations, also, it is possible that certain putrefactive bacteria may attack the proteins, releasing ammonia and material of no nutritional value. It is obvious, therefore, that for the production of the most palatable silage, with the minimum amount of waste and loss of dry matter, a degree of compaction in the silo is necessary to ensure as great an exclusion of air as possible; but should the material be of a nature that over-exclusion of air might occur, then steps must be taken to ensure that the proper type of fermentation is encouraged.

Very close compaction is possible with material which has been chopped, with material predominantly leguminous, or with young leafy grass. In the case of these materials, due either to over-compaction or the fact that the composition of the material is such that carbohydrate material is not available in sufficient quantity to produce the desired level of lactic fermentation, it is necessary to assist the process by the addition of some form of carbohydrate.

Sugar is the most easily assimilated form of carbohydrate for this purpose, but apart from the expense of sugar, the greater convenience of molasses or treacle makes the latter the universal choice for this purpose. Molasses requires to be diluted with water before it can be applied, so that the major portion of the material to be ensiled comes in contact with the solution. A dilution of two volumes of water to one of molasses is often recommended, but in practice, especially when dealing with 'springy' material, a dilution of three or even four volumes assists in the efficient dispersion of the solution and proper consolidation of the material. This solution is usually made up in barrels on the spot, and dispersed either by watering-can with an enlarged rose, or, if silage is produced on a big scale, by a pressure-fed spray. The requisite amount of the solution is usually applied to six-inch layers of the material, the quantity applied to the upper layers being on a more generous scale to allow for downward seepage.

The total quantity of molasses required for a particular silo can be calculated, within limits, by multiplying the capacity of the silo with a factor which takes into account the composition of the material to be ensiled. The capacity of a given silo, however, will vary with the type of material to be ensiled. Dr S. J. Watson of Jeallot's Hill suggests as a guide for grass silage the following amounts per ton of green material :—

	Molasses addition
Grass, fairly mature, with little clover .	15 lb. per ton.
Grass, with clover admixture . . .	25 "
Very young grass, or leguminous crops .	40-50 "

Other methods designed to assist in the conservation of silage have been tried, but for several reasons none have superseded what is now looked on as the Standard Molasses Treatment. Short mention may be made of some of these methods. The A.I.V. process, evolved by Professor Virtanen of Helsinki, recognised that the rapid acidification of the material to be ensiled was desirable if fermentations, calculated to produce acids such as butyric acid, were to be avoided. An acidity level of around pH 3.5-4 is reached almost at once by an application of mineral acids, at which point bacteria

capable of producing harmful fermentations are destroyed. Virtanen was also able to show that fermentation losses were very materially reduced as compared with 'natural' silage. Losses in organic matter were shown as low as 2 per cent in the case of A.I.V. fodder, as against 12 per cent in ordinary silage. A.I.V. fodder was produced experimentally at many centres in this country some years ago, but, owing to the number of practical difficulties in adopting the technique on ordinary farms, the process made no headway. It was found that the acids were difficult to handle, and that acid-resisting equipment was necessary for all stages of the process. The silage which was produced at different centres was generally of a high order, and most of the claims made for the process were fully justified. It was in the utilisation of this material, however, that most of the practical difficulties were met. The silage was extremely acid in character, and, unless treated with powdered chalk at the rate of $\frac{1}{4}$ lb. per cwt., caused considerable irritation to the mucous membranes inside the animal's mouth when fed to stock.

Other ensilage techniques, designed either to sterilise the material as it is filled into the silo, or again by introducing bacterial cultures calculated to produce a lactic fermentation, have all been tried but found wanting in some respect. The application of the latter process, however, as an adjunct to the molasses treatment, offers scope for further investigation.

CROPS FOR ENSILAGE.

Cereals, clovers, legumes, and grass are the basic ingredients of almost all silage. Crops specially grown for silage purposes are based primarily on some cereal with a legume added to increase the protein content of the mass. It can also be readily understood that the expense of growing and ensiling an acre of cultivated silage will be considerably higher than the expense and handling charges for an acre of grasses and clovers. This higher overhead expense, however, is to a large extent offset by the increased quantity of material that can be grown from an acre as compared with grass. In Scotland the cereal used principally for silage purposes is oats. Many useful crops, however, have resulted, particularly on exposed land, when mixtures of oats and rye have been used. When oats are used as the principal cereal, it will be found that early seeding and choice of a 'straw' type of oat will greatly increase the output. Such varieties of oats as "Castleton Potato," "Sandy," or "Marvellous" would be definitely more desirable than "Yielder" or "Victory" for the purpose of silage. Cultivated silage crops are generally sown in spring in Scotland and cut at an immature stage, judged to be ready when the grain reaches the 'milky' stage. At this stage the

cereal part of the crop is capable of supplying enough carbohydrate material to develop, after fermentation, an acidity level able to preserve the more valuable protein-rich constituents of the sown mixture. The protein-rich ingredients of a silage mixture are usually derived from tares, beans, and peas, either together in mixture or singly. Beans will be included if the conditions appear to be suitable for that crop—namely, land on the 'heavy' side, where the rainfall is adequate and the land in reasonably good fertility. Tares are less selective and grow well on most classes of soil. Where conditions do not appear suitable for beans, however, a heavier seeding of tares should be made. Peas do fairly well on medium classes of soil, but do not yield well on very light land.

It is usually found advantageous, when beans are included in the mixtures, to sow the beans separately some two to three weeks before the other constituents of the crop. This lengthens the growing period for the bean, which is slower to germinate and start growth than oats or tares. It also ensures that no smothering takes place by the quicker-growing cereal. No hard and fast rule can be laid down about mixtures suitable for differing conditions and classes of soil, but the following seeding per acre would suit most classes with slight modifications for varying conditions:—

Oats	.	.	.	.	.	2 -2½ bushels.
*Beans	.	.	.	.	.	1½-2 „
Tares	.	.	.	.	.	1 „
Peas	.	.	.	.	.	½ „

* Carse, Horse, Spring or Tick

If beans and peas do not suit the conditions, an excellent forage crop can be obtained by seeding the following simple mixture per acre:—

Oats	.	.	.	.	.	2½ bushels.
Tares	.	.	.	.	.	1½-2 „

A new use for silos has been found since the advent of the ploughing-up campaign. Many of the old lea fields now being ploughed up and seeded with oats have proved to be much too richly endowed with accumulated nitrogen, with the inevitable result that portions and sometimes whole fields had lodged.

To harvest these crops in the usual way would involve much labour, and the return from sales of grain would usually prove uneconomic. This lodged grain can be handled in two ways: (1) by cutter-blower equipment for 'short' silage; (2) by conversion into 'long' silage in pits. Useful silage with a feeding value some two to three times that of turnips can be made, providing the material is cut when it starts to

lodge, and is ensiled immediately. The longer the material is lodged, the lower becomes its value as silage. Cut at the early lodged stage, the succulent corn shoots can be converted, without chopping, into good silage in pits. Long corn does not ensile readily in portable or tower silos, owing to the difficulty of compacting it sufficiently to control fermentation temperatures. In pit silos, where the weight of the horse and cart can be utilised, it is usually possible to achieve the necessary compaction by running this combination over the mass of fodder. The resultant silage is usually very useful. The volume of chopped oats compared with long oats is approximately one to three. Chopping and blowing the laid material is, therefore, most certain of good results, as the necessary compaction can be more readily obtained. The quantity of molasses necessary to ensure the production of the best silage has already been dealt with, and should vary with the crude protein content. This factor, in the case of cereal and legume silage, will vary with the content of legume present in the crop.

On farms the most valuable silage from the nutritional point of view is made from grasses and clovers. Young grass, before it reaches the fibrous stage, has a value similar to a protein concentrate, when assessed on its dry-matter content. Summer flush grass, when properly ensiled or artificially dried, has been shown to possess the qualities usually associated with the same grass in the natural state—namely, that it possesses a high biological value, is easily digested, and can be readily converted into milk or beef.

There are few farms, however, which are now in the happy position of having or expecting a summer 'flush,' owing to the plough policy, but there are many farms where foggage, which is often largely wasted by sheep, could more usefully be conserved in silos for winter use. The summer of 1940 was very kind to the growers of second crop hay, but such weather conditions cannot always be expected. Suitably manured second cut can be made into excellent silage material, returning not infrequently a crude protein content of 16-19 per cent based on dry matter. Again the quality of the material depends on (1) cutting and ensiling before the material becomes 'stemmy'; (2) adequate trampling to ensure proper compaction; (3) encouragement of a proper lactic fermentation by the addition of molasses.

Crops such as lucerne, maize, and sunflowers are sometimes ensiled in England, but for all practical purposes have no place in our Scottish agriculture. In the 'Transactions' of 1940, Professor J. A. Scott Watson dealt with the Continental practice of ensiling potatoes. This opens up a new field for ensilage in this country, and in view of the livestock rationing scheme, should make some appeal to stock-owners this summer.

Potato silage was made at Boghall during the past summer in one tier of a 'Sisalkraft' silo. The potatoes were first of all steamed, then filled into the silo without further treatment. As the steaming capacity was limited, some ten days elapsed before the silo was filled and finally sealed off. After a period of five months the silo was opened and the resultant silage fed to in-pig sows. The silage varied in quality, as the lower portion of the silo, where the potatoes had been more thoroughly compacted and pressed, was of good quality and appeared to be palatable, whereas the upper portion of the silo had pockets where putrefactive breakdown had produced foul-smelling unpalatable material. The secret of making good potato silage would again appear to lie in thorough compaction. In a pit compaction might be easier, and it is in pits that most of the potato silage on the Continent is made.

An alternative method of ensiling potatoes along with grass has probably more to commend it than pure potato silage. Layers of potatoes and grass are filled into the silo in the proportion of one of potatoes to three of grass. The heat raised by the fermentation of the grass is sufficient to 'cook' the potatoes, which are then prevented from further deterioration by the organic acids produced by the fermentation in the grass layers.

Attempts to ensile crops of the Brassicæ family—marrow-stem kale, thousand-headed kale, rape, &c.—have often been made, but with little success. The dry-matter content of all these crops is relatively low when compared with grasses and cereals. A type of silage is produced which tends to become either too compact or too open, depending on whether the crop has been chopped or not. In both situations fermentation changes take place which eventually lead to some putrefaction. It is possible, however, either by use of mineral acids or molasses, or by improving the 'consistency' of the mass by adding some fodder crop, to produce silage which is palatable and suitable for feeding to stock. A successful standardised method of ensiling marrow-stem kale would go a long way to solving late spring and early summer shortages of succulent material, which could be used to maintain the production of milk until the grass is ready.

SILOS.

The silo or the container in which silage is made must conform to the following specifications:—

- (a) The container must be rigid to withstand the stress and strain of heavy material.
- (b) As near as possible the container should be air-tight and smooth on the inside to allow the material to sink evenly.

- (c) The silo should be built on a level base and be of a size to satisfy the necessary feeding requirements.
- (d) The situation of the silo must be convenient for filling and stock-feeding purposes.

Silos are built in many forms, ranging from tower silos with a high tonnage capacity to small portable silos with a low tonnage capacity. Broadly speaking, the most efficient silos are the large tower silos. The area of possible air contact is smaller with these silos, in relation to the cubic capacity held, than with small portable silos.

TOWER SILOS.

Tower silos can be built of concrete, stone, brick, wood, or steel, but most commonly are made of concrete. After the war of 1914-18 many of these silos were erected in Scotland, and until about 1925 silage making became part of the regular routine on the farms owning one. Since about that time many of these silos have fallen out of use owing to a variety of causes, but the chief cause for their decline in use from 1928 until the war was dictated by economics.

Tower silos require a heavy labour complement, which limits their scope to fairly large arable farms, and it was this factor mainly which influenced their lack of popularity during the 'lean' years. Up till this war a well-constructed tower silo, to hold up to 200 tons of silage, could be erected for £600, with cutter and blower facilities extra, but few landlords or tenants were in a position during recent years to face capital expenditure of such a nature, with the result that few new tower silos were erected.

The most efficient tower silos are round in shape, and have smooth walls inside. They should have a roof to keep the rain out, and a window built in at the top for light. On one side there should be a series of doors, at conveniently spaced levels, leading to a chute down which the material is dropped to a shed below. A small door at the top of the silo receives the blower pipe from the chopping blower machine below.

The organisation on a farm possessing a tower silo must be carefully worked out. Firstly, there is the capacity of the silo, which will determine the acreage of the silage crop to be grown. The minimum labour complement necessary to cut, gather, cart, chop and blow, and handle the crop inside the silo will also have to be carefully considered. Chopper-blower capacity largely governs the speed at which a particular silo can be filled, and it is estimated that moderately good organisation should manage to deal with about 25 tons of silage per day.

Lastly, and probably most important of all, planning of the consumption rate, whether the silage be fed to dairy cows or beef bullocks, must be worked out. Once silage is broken into, it must be consumed at a reasonable rate, otherwise the freshly exposed layers of silage will start to ferment again and result in spoilt silage. The quantities of silage which can be fed to stock will be dealt with later in this article.

When a tower silo is actually being filled the following points should be particularly watched :—

- (a) Keep the centre well filled up and confine most of the heavy treading to the outside. Treading should be intensified near the top of the silo.
- (b) Do not fill the silo too rapidly. Allow time for the material to settle down ; this will help to induce the proper type of fermentation. In this respect it is often useful to fill the silo on alternate days until completed.
- (c) Unless some precaution is taken to seal off the top of the silo, some 8-12 inches of waste material should be blown up at the end of the filling process to reduce the spoilage by mould growth at the exposed surface.

It is not customary to treat oat, bean, pea, and tare silage with molasses, and, providing the material is ensiled at the proper stage, it is doubtful whether any benefits would accrue from such an addition. Second-cut ryegrass if ensiled in a tower would probably turn into better silage if treated with molasses. The quantity usually applied to a crop which is not too far advanced would be around 25 lb. of molasses per ton of green grass. Grass silage made from young grass is seldom made in tower silos and is mostly made in temporary portable silos.

The number of makes of silo falling into this important group is now legion. Temporary silos have the distinct practical advantage over the tower silo of mobility, and are generally suitable for medium-sized or small farms. These silos can be made of precast concrete slabs, wood, or steel wire framework with paper lining.

PRECAST CONCRETE SILOS.

These silos are constructed of reinforced concrete slabs, each slab weighing from $\frac{1}{2}$ to $\frac{3}{4}$ cwt. The slabs fit one to the other by means of bolts, wires, or in some cases by slots, and can be tiered up to almost any convenient height. The inner side of these slabs and their joints are usually smooth to allow even settling of the material. As with other silos, it is essential to build up from a level foundation. This type

of temporary silo has many advantages over other types in that it is more durable and has a low depreciation. The initial capital outlay, based on the cubic capacity, is, however, relatively higher than for wooden or steel wire types, but when depreciation is taken into account it may be cheapest in the long-run. Many of these silos have provision made for filling and emptying by means of panels which can be removed at various levels to ensure ease of handling. Temporary silos present no serious filling difficulties, but to ensure that the maximum amount of silage is held, they should be filled in stages to allow proper settling to take place. Green material ensiled under average conditions will shrink from a third to a half of its bulk. It therefore follows that in order to fill the silo to capacity, some time must elapse between each filling. In practice this is best effected by filling one tier at a time and allowing from two to three days between each filling. When the silo is filled completely and a good cone left at the top, it will be found that a final shrinkage will take place, which should be made up again before the silo is finally sealed off. The period of time to allow for this final settling will vary with the material being ensiled, but normally three to four days should be sufficient for this purpose. Final sealing off at the top is without doubt the most important factor in the filling technique, and here again the best results are obtained by completing the silo with some waste material to 'absorb' the mould growth near the surface. Best results are obtained if the crown is thatched with straw or waterproof paper, sisalkraft paper being excellent for this purpose, and the top weighed down with soil to a depth of not less than 6 inches. Many silo owners complete this sealing process by sowing some hay seed or cereal on top of the soil, as this completely binds the soil together and produces an impervious mat of roots, which assists in keeping much of the rainfall out of the silo. Some wastage may take place round the edge of the silo near the top. This is caused by rainfall soaking down from the crown of the silo to the sides. A well-filled silo, however, should not suffer from this drawback if, as has been pointed out before, the centre is well filled up and the crown made high above the level of the upper rim of the silo. If this is done it should be possible to 'shed' the rainfall over the outside edge of the silo.

WOODEN TEMPORARY SILOS.

Temporary silos may be built of wood, and, on account of their relative lightness, can be erected in bigger sections. Wooden silos do not possess any special advantages over concrete silos except lightness and greater ease of handling, and are subject to all the drawbacks of wooden structures

which stand out in all weathers, in particular shrinkage when empty and dry, and general deterioration.

Many wooden silo users now use the upper tier as an over silo which holds the material only until such time as it shrinks down to the under tier, the over silo being then removed and the remainder of the silo sealed off. This over silo is then available for other silos.

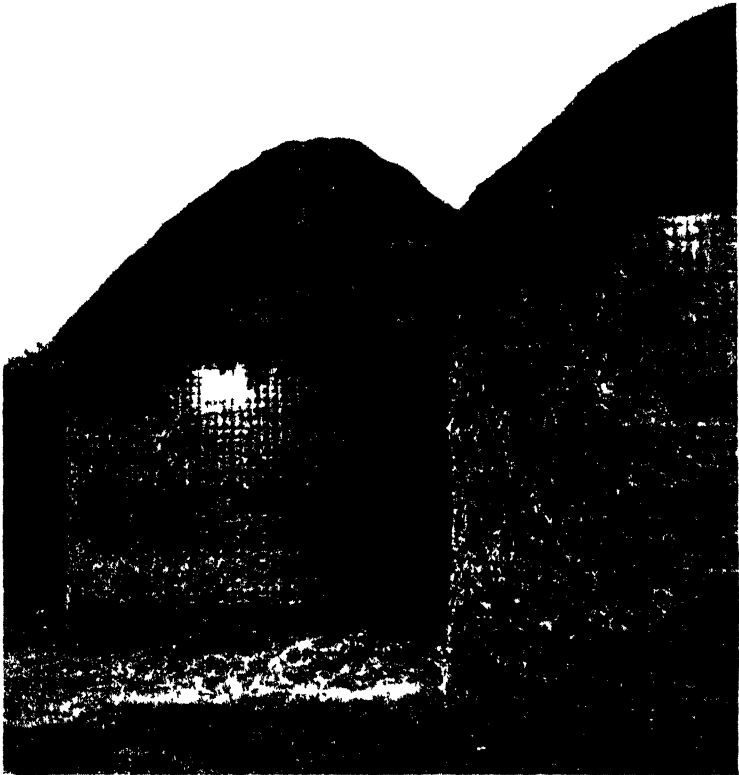


Fig. 2.—Two completed Sisalkraft silos. Note the well finished crowns which assist to “shed” off any rain water

STEEL WIRE AND PAPER SILOS.

This type of temporary silo is probably more widely used than any other, and apart from being moderately priced is light and easy to erect. Each silo consists of three or more rolls of steel wire with a roll of treated paper for lining purposes. When erecting this type of silo it is again of great importance

to choose a level site. One tier of wire is unrolled, and, after it has been placed in a circular position, the ends are laced together forming the framework of the silo. Inside the framework pieces of treated paper are attached and held in position by clips until such time as the material inside presses the paper against the steel wire and holds it in position. The second tier of wire, whose circumference is made smaller by overlapping the wire framework another mesh, is held in position on top of the first tier by twine. This tier is also lined with treated paper and the material filled in as before. Whenever the downward pressure of the second tier is such that the twine-tied wires begin to bend, the ties are cut and the upper tier allowed to telescope inside the lower section. This process is repeated in the upper tier. The rules of good silage building apply particularly to this type of silo, and great stress must be laid on sufficient treading round the sides. Care is needed to top off this type of silo so as to produce the dome shape which is so essential if wastage is to be avoided.

While these silos can be extremely efficient when properly handled, they are by no means foolproof. Careful attention is needed when the silo is telescoping to ensure that the wires do not catch and cause tears in the paper lining, as such tears would admit air and spoil much of the silage in the immediate vicinity. The paper lining supplied with these silos may be torn when stressed under certain conditions. A recent trial at Boghall, where a rubber lining sheet was used, and which may be used again for a second season, appears to have certain advantages which are worthy of further development.

PIT AND TRENCH SILOS.

This type of silo has met the need of the farmer who desires a relatively inexpensive container, where he can be fairly certain that storage losses will be at a much lower level than silage made in a stack. Pit or trench silos, as the description implies, are excavations in the ground and are made of such a size as to suit the volume of the crop to be ensiled.

Recent developments in pit and trench silo work have shown that certain requirements are necessary for the production of the best silage. The excavation should firstly be made on gently sloping ground where the subsoil is known to be reasonably porous, and it is considered an advantage to have sloping sides to the trench to ensure thorough compaction and settling. Drainage facilities should be provided to cope with excess juice from the silage and with the possibility of water working into the pit from the adjacent ground. The floor of the silo should, therefore, be sloped towards the

centre to allow for a fall to the lowest end where this water or excess juice may have freedom to escape. Failure to provide for proper drainage may lead to the formation of sour, evil-smelling silage in the bottom layers of the pit. Many trenches are now lined with concrete or wood. The former need not be thicker than two inches, and can be readily built on the farm with inexperienced labour, provided an adequate supply of shuttering is available and a proper aggregate mixed up. Lined pit or trench silos have great possibilities for



Fig 3 — *Trench silo showing material being cut out in sections*
Note slope on sides of trench

further development, and the Government would do well to exploit and popularise this type of silo for the greatly intensified campaign promised for 1941. Silage is filled into these trenches or pits without previous chaffing. In silos of this type 'laid' crops can be most usefully handled. A normal pit might conform to the following dimensions: depth, 4 to 6 feet below ground level, with the sides sloping 9 to 12 inches inwards from top to bottom; width, 10 to 14 feet, or sufficiently wide to allow the passage of a horse and cart; length, to suit the amount of material to be ensiled.

It has been estimated that a trench 10 feet wide, 5 feet

deep, and 2 yards long should hold approximately one acre of mashlum. The excavated soil is thrown to both sides of the trench, being used later for 'sealing' purposes. When silage is being filled into a trench, it has been suggested that the first foot should consist of wilted material, with a view to counteracting the possible formation of sour 'butyric' silage. Filling should proceed at a moderate rate with a short lapse of time between each filling. Many trench silo users fill on alternate days. This, it is claimed, allows the material time to settle and produce the desired type of fermentation. When the ground level is reached, trampling can be greatly assisted by running a horse and cart over the silage to ensure thorough compaction. To make allowance for the natural shrinkage it is necessary to continue filling the silo until it is some 6-8 feet above ground level. Thorough compaction is still possible at that stage by building the ends of the trench on the slope. This enables a horse and cart to run over the material. To complete the silo it will be necessary to cut these 'slopes' off with a hay knife, the material being thrown on top of the silo.

As some wastage appears to be inevitable in the surface layer, it is considered advisable to finish this surface layer with waste or valueless material which can be discarded when the silo is opened.

Final sealing off is extremely important if waste is to be kept at a minimum, and thatching firstly with wheat or rye straw is recommended. This straw should be covered with about 8 inches of soil, which covering should be increased to one foot when shrinkage has ceased. The final shape of the trench should be in the form of a dome some 12-24 inches above soil level. When opening the silo, this should be done by starting at the lower end and cutting out sections with a hay knife as required. If these recommendations are followed, it is possible to produce excellent silage with a very low percentage of wastage. Grass, either grown for the purpose, or 'toppings' from rough pastures, can equally well be treated in this manner.

STACK SILAGE.

This system of ensilage cannot be recommended unless to conserve a great bulk of relatively valueless material. The system has the distinct advantage of requiring no capital expenditure, but the losses generally experienced far outweigh any advantage on this score.

As the name implies, stack silos are built above the ground in the form of a stack, but it can be readily imagined the surface area exposed to the air favours rapid fermentation, with inevitable wastage round the sides and over the top.

If the consolidation has been sufficiently hard and the stack properly heated up, wastage can be reduced to 1 foot round the sides. This might not be serious in a stack of large diameter and capacity, but in a small stack of 10 foot diameter the percentage of waste is obviously excessive. Fermentation temperatures are always high, which results in a reduction of the digestibility of the protein constituents in the crop. Great difficulty is experienced with stack silos during shrinkage. This shrinkage is influenced by the degree of compaction and the direction of the prevailing wind, which will 'cool' the stack on the windward side, thus reducing the amount of shrinkage, while on the lee side shrinkage will be more pronounced, resulting in a lop-sided stack. Silage from a stack silo has a sweet smell and is black or dark brown in colour due to charring caused by the high temperatures produced. Losses due to fermentation and wastage of material can be expected to range from 30-50 per cent, and must, therefore, be considered excessive.

An article appearing recently in the agricultural Press analysed the results obtained from 300 silos during the 1940 season, when the following interesting facts were brought out :—

Type of Silo.	Number of each type inspected.	Number with less than 5% wastage	Percentage.	Number with over 25% wastage.	Percentage.
Wire and paper .	110	60	55	15	13
Wood or concrete.	74	62	84	3	4
Home-made .	68	29	43	12	17
Converted buildings	32	12	38	9	28
Stack . . .	9	2	22	3	38
Pit . . .	7	4	57	2	28

It will be noted that the concrete and wooden types of silo have had the highest measure of success, while stack silos have generally shown a high degree of waste. These results bear out the observations already made in this article. It was suggested that much of the lack of success in silage making covered by this 1940 survey was due (1) to faulty treading or lack of proper consolidation ; (2) to improper sealing off ; (3) to wastage caused by shrinkage inside the rim of the silo, thus forming a gutter to collect rain-water which resulted in spoilt silage down the sides.

FEEDING VALUE AND UTILISATION OF SILAGE.

The feeding value of silage will depend on the crop to be ensiled and the stage at which it is harvested, coupled with

the fermentation changes which may have taken place according to the methods employed. Broadly speaking, the value of oat and tare silage, cut at similar times, will be the same wherever it may be grown. On analysis, grass silage should be regarded not so much as a root substitute, but as a weak concentrate, with the added succulence associated with root feeding. Under practical farming conditions good grass silage may be substituted for hay and the roots usually fed. Good quality silage can be fed to almost any class of stock, but undoubtedly its most useful place is in the ration of the dairy cow or the feeding bullock. Stock fed on silage are maintained in a healthy and sound condition, while the milk from the dairy cow has the qualities usually associated with animals at grass. The best protein-rich silage is undoubtedly made from young grass, but silage of equally high energy value, but lower protein content, can also be made from mixtures of beans, peas, tares, and oats. As the proportion of cereal to legume increases, the protein value of a sown silage mixture will decrease. The following table compiled from data collected at Boghall and elsewhere gives the approximate percentage dry-matter composition of different classes of silage :—

	Young Grass Silage.	Second-cut Silage.	Oat and Tare Silage.
Crude protein	18	15	11
Carbohydrates	45	48	44·5
Ether extract (oil)	4	4	3
Crude fibre	23	24	33·5
Ash	10	9	8

The moisture content of silage varies with the crop, and the stage at which it is cut, but for most classes of silage will fall between 75-80 per cent.

Silage can be fed to calves at an early age. A ration of half a stone per head per day could be offered to calves from the age of six months. This ration could be progressively increased up to the yearling stage, when as much as two stones could be safely consumed. The quantity of silage which should be fed to dairy stock will be based on its quality, but rations allowing over 1 cwt. per head per day have been fed with good results. A feed of 50 lb. of protein-rich grass silage per day should be capable of maintaining a dairy cow, and allows of the use of cereals for the rest of the production ration.

Stock unaccustomed to silage feeding should be introduced gradually to this class of feed, but once they have acquired

the taste, they eat their rations with evident relish. It should be pointed out, however, that silage should be fed to dairy stock after milkings to prevent any possible chance of taint in the milk.

The poorer grades of silage, whether they are produced from grass 'toppings,' laid oats, or mature second-cut ryegrass, should be regarded only as a substitute for average quality hay.

Well-made silage produced from young grass and clover may, on account of its high protein content, be used in place of balanced concentrates for the production of milk or beef. No harm will come to stock fed almost exclusively on this very rich silage, but, on account of its protein content, this would be wasteful. Better results could be obtained if this rich silage was suitably supplemented by a proportion of some cereal food to achieve a proper balance.

The following daily allowances are examples of how silage could be employed in rationing the following classes of stock :—

- (1) For the production of 1 gallon of milk—
20 lb. high quality grass or clover silage, or 15 lb. average quality silage plus 1 lb. of some protein-rich cake.
- (2) For the maintenance of a 9-cwt. cow and the production of the first gallon of milk—
70 lb. average quality silage.
- (3) For the maintenance and growth of yearling cattle—
35 lb. average quality silage.
- (4) For the maintenance and fattening of a 9-cwt. bullock—
100 lb. medium or low protein silage.
- (5) For the maintenance and production of a suckling cow—
100 lb. of medium to good quality silage.

SUMMARY.

It is more necessary to-day than at any other time in the history of this country that our live stock food requirements should be met from home-grown sources. If the livestock rationing allocations now being issued are a barometer of the feeding-stuff position, then it seems obvious that very substantial efforts will be necessary on all holdings where stock are kept to make them as near self-supporting as possible for the autumn and winter of 1941-42. Silage can play an extremely important part in this self-sufficiency campaign, and, provided that certain fundamental principles are observed, can be produced successfully on all farms. As an aid to maintaining the productive capacity of our dairy herds and the output of beef cattle, the production of large quantities

of silage is now sound practical politics. Material thus conserved has a much higher nutritive value than similar material which has been dried into a 'hay' condition.

Materials which can be made into useful silage are legion, but particular attention should be paid to well-made grass silage, which has a dry-matter value approaching good cotton-cake. During the coming season it is more than probable that some cereal crops, taken after old lea, will be 'laid.' This 'laid' fodder should be ensiled immediately it is obvious that the crop will not rise again.

Tackled at this early stage, ensilage of considerable value can be obtained, whereas the alternative may be complete loss. The production of silage on most farms can be conveniently sandwiched in between other major summer operations, such as haymaking and the corn harvest. It need not, therefore, compete with the labour requirements of these periods.

Several points are worth stressing in the actual technique of silage making and worth repeating here :—

(1) Except in specialised instances complete and thorough consolidation is the crux of the whole process of silo filling. Short grassy fodders need not be cut to achieve the desired consolidation, but silage crops of cereal, beans, peas, and tares should be chopped up before filling into the silo. 'Laid' crops, provided they are tackled quickly enough, can be ensiled in the long condition, this operation being most successfully carried out in trench silos.

(2) The material should be filled into the silo in a fresh condition ; wilted or partially dried fodder never ensiles well. An exception to this rule is in the filling of trench silos, where it is an advantage to fill the bottom of the trench with wilted material. Contrary to the opinion held by many people that silo filling can take place regardless of weather conditions, it is necessary to remember that if material is too wet, undesirable fermentation may take place, which may spoil the palatability of the resultant silage.

(3) The whole process of silage making depends for success on the complete exclusion of air. Any process, therefore, that will assist this requirement should receive the most careful attention. This warning applies particularly to the 'sealing off' of temporary, trench, and pit silos, where the rules applicable to the building of a good stack apply. The heart should be well filled up so as to leave a good top, which in turn will help to shed the rainfall.

(4) For the coming campaign particular attention should be given to the construction of trench silos with reinforced sides. This type of silo is as nearly foolproof as can be, and has the advantage of requiring no materials from overseas in its construction.

The many technicalities involved in the production of good silage may appear frightening to many who are contemplating its production, but should the few simple fundamental rules be observed there can be no doubt as to the ultimate success. Excellent services, which are always available, are offered by the Agricultural Colleges or the Executives of the Agricultural Committees in cases where further advice or discussion is needed. Silage can help us win the war. Let all in a position to help 'go to it.'

THE BRACKEN PROBLEM.

By J. F. TOCHER, D.Sc., LL.D., F.I.C., Aberdeen.

THE FEEDING VALUE OF BRACKEN.

AMONG the many unsolved problems in front of the Scottish farmer is the problem of a practical method of destroying bracken or utilising bracken as part of a ration for live stock. I give, in Appendix I., a list of references to bracken, showing how often the problem has been in front of the Directors of the Highland and Agricultural Society. It will be seen that no less than twenty-three references have been made to bracken, mainly bracken fronds, popularly known as leaves. It has been established that bracken rhizomes have a feeding value [1]. The cost, however, of utilising the rhizomes, popularly known as roots, is such as to render doubtful whether bracken rhizomes could be used on a commercial basis throughout the country as a feeding stuff for pigs.

It is well known that bracken fronds were used by crofters in the Highlands in days gone by. It is highly probable that young fronds were used. There does not appear to be any evidence of illness among the live stock in the Highlands by the use of bracken. Analyses have been made showing the composition of bracken, especially from the point of view of the nature and proportion of mineral matter present.

Wolff [2] found young fronds to contain 1.9 per cent of potash, 0.6 per cent of lime, and 0.4 per cent of phosphoric acid. Using Wolff's figures and considering the bracken fronds as moisture free, the proportions of minerals found were as follows: 2.5 per cent potash, 0.8 per cent lime, and 0.5 per cent phosphoric acid [3]. Experiments on young bracken fronds have been conducted in Russia [4]. The bracken, however, was treated with dilute acid (strength not specified) and made into silage, which was kept for approximately nine months. The silage was proved to have no harmful influence on farm animals. The amount of protein present was about 3.2 per cent, and the proportion of ash present was 1.3 per cent. It is clear from the low proportion of fibre found—namely, 5.6 per cent—that *young* bracken collected early in the summer was used for making this

bracken silage. The undernoted table (Table I.) gives the results of the Russian analysis.

TABLE I.

	As collected. Per cent.	Moisture free. Per cent.
Water	80·45	
Albuminoids	3·18	16·27
Nitrogen-free extract	8·78	44·91
Fat	0·73	3·73
Fibre	5·56	28·44
Ash	1·30	6·65
	<u>100·00</u>	<u>100·00</u>

Watson, in writing of the Finnish system of the storing of silage in general, says that with this method acid is added to the material ensiled, in order to check fermentation and to prevent the destruction of nitrogenous substances. By this means the nutritive value of the forage is retained with very little reduction in the bulk of the material.

It is stated by Winton [5] that bracken fronds are a common food in Japan and China and also in Hawaii, where there is a large oriental population. The proportion of protein found present in the young bracken shoots was low—namely, 1·1 per cent—while the proportion of fibre was also very low, 1·5 per cent.

THE ERADICATION OF BRACKEN.

The eradication of bracken was the subject of an article by K. W. Braid of the West of Scotland Agricultural College [6].

Braid described the various instruments and implements used for the destruction of the fronds. He gave several reasons why bracken spreads, and suggested that carbohydrates could be fermented for the production of power alcohol and the fibre converted into bracken board.

Bracken control has also been studied by Principal Paterson of the West of Scotland Agricultural College [7]. Paterson states that recent investigational work has demonstrated that bracken cut before it gets too strong and fibrous can be made into quite useful silage. The addition of molasses he holds was necessary for the best results. He further suggests that fuller use might also be made of bracken as a litter for cattle, as a covering for potatoes, as a compost, and as a source of potash. So far as bracken being used as a litter for cattle is concerned, complaints have been made that the cattle eating the litter have, in certain cases, become ill, due, it is held, to bracken containing a substance injurious to live stock.

THE VALUE OF BRACKEN SILAGE.

Experiments have been conducted at Jealott's Hill Research Station in order to find out the value of bracken silage by itself as a feeding stuff, particularly at different stages. S. J. Watson found that *old* bracken fronds were too 'woody,' did not pack well, and heated very strongly when made into silage. The best results were obtained by bracken cut shortly after the fronds were newly open. If a silage were made with young bracken fronds it was found that the silage was palatable to live stock, especially if molasses were used as a stimulant. Watson gives his opinion that bracken silage could not be graded as a really good feeding stuff, but there was no evidence that young bracken fronds contained any substance which would be injurious or dangerous to health. He found that sheep consumed large quantities of bracken silage for three or four weeks without any apparent harm.

Hendrick [8], in the course of his investigation of bracken rhizomes, gives the results of analysis of bracken fronds collected at various periods during the summer. He found high proportions of fibre in mature bracken fronds and higher proportions of protein in fronds collected in the early autumn.

Goodall tells us that he has learned, from a study of the traditional uses of bracken in the Highlands, that the crofters use the juice on the outside of the bracken as an ointment as well as using the dried fronds as a fodder.

BRACKEN POISONING.

Braid [9] states that in British Columbia and Oregon bracken poisoning of horses took place where horses were fed in the winter on hay containing bracken. The illness is known as 'staggers.' He states, however, that a concentrated water extract of bracken had no poisonous effect on live stock, showing that any poisonous principle present was insoluble in water. These feeding experiments were conducted by Hadwen and Bruce. Hay containing from 6 to 9 lb. of bracken per day caused the death of live stock in about five weeks. Muller [10] found that horses became ill after prolonged feeding with bracken silage. He does not, however, state the proportion of bracken present in the forage. Illness in cattle fed on bracken was first noticed in this country by D. M. Storrar [11], who held that the disorder was probably due to indigestible food and not necessarily to a specific toxic effect. Lander [12] says that poisoning by bracken is a so far obscure disorder often observed in cattle in the early autumn (from August to November) after

eating bracken. The plant is taken, although other given foods may also be available. Lynch [13] describes a case where six animals became ill, developing salivation and stertorous breathing. Without any chemical or bacteriological examination of the bracken, Lynch held that the illness of the six animals was due to bracken poisoning.

Another case of reputed bracken poisoning is given by Craig and Davies [14]. It is clear from their communication that the bracken fed must have been old and not young fronds, as the animals became ill in October. It appears likely that bracken fronds in the mature stage, if consumed without any dilution with other silage, are dangerous to the health of live stock.

Sir Stewart Stockman [15] reported on a case of reputed bracken poisoning in 1918. Stockman conducted experiments on a bull calf about eight months old, feeding the calf with bracken shoots cut daily round the pastures of his laboratory. He stated that the bull calf ate the bracken quite readily from the 20th September 1917 until the 18th October—twenty-nine days. It thus appears likely that the bull consumed mature bracken fronds to the extent of a total of 260 pounds. He stated that on the twenty-sixth day of feeding the animal appeared tucked up and ill. The calf was found dead on the 19th October—the thirtieth day. It is clear from this result that *mature* bracken fronds fed continuously without any other forage are dangerous to live stock. No attempt was made by Stockman to ascertain chemically whether there was a substance present which might be poisonous to live stock. He concluded, however, there must be, on account of the illness of the animal. He ventures a guess that a toxic substance, perhaps ricin, may have been present. Ricin is known to be a cumulative poison. He also conducted experiments on two heifers, feeding them with bracken for several days. Apart from symptoms of indigestion, he stated that there were no ill effects on the animals from the feeding of bracken. He referred to the possibility of a plant known as Cinquefoil (*Potentilla*) being of a poisonous character. The experiments he carried out were inconclusive.

Hadwen [16] gave experimental proof in 1917 that horses could be killed with feeding with *old* Canadian bracken.

Experiments with bracken silage have been conducted by Thomas on sheep at Newcastle-on-Tyne, but no report has as yet been issued.

Reports on suspected bracken poisoning have been published by French veterinary surgeons.

Kerdiles [17] is of opinion that considerable losses in cattle occur in Brittany due to bracken poisoning. Lominet and Lavieille [18] give an account of the clinical symptoms in a small herd of cattle fed indoors (in a cattle shed) on bad meadow

pasture for three months. The pasture was found to consist of about 25 per cent of meadow grass and 75 per cent bracken fronds (not the rhizomes). The animals suffered severely from diarrhoea. The post-mortem appearances of a fatal case were fully described. Bacteriological examinations on the contents of the alimentary canal were made with negative results. The authors, however, conclude that the illness was due to some sort of poisoning by bracken fronds. No chemical analysis, however, was made and no information was given as to the age of the fronds when cut. It was stated that hay kept for winter feeding was usually free from bracken. They quote Professor Henry of Alfort as holding that bracken had poisonous properties. No details are given in support of this conclusion.

RESULTS OF RECENT ANALYSES.

A number of analyses of bracken fronds has been made for members of the Society. I find that young fronds are valuable as a feeding stuff, especially if made into a silage along with grass or hay. The fronds were very variable in composition, due mainly to the month the bracken was cut, and also to the geographical source. The fronds collected in the southern part of Angus were found in July to yield 18 per cent of protein (moisture free), while fronds collected at the same time in Morayshire and Aberdeenshire contained only 14 and 15 per cent respectively. Fronds collected in August contained 36 per cent of fibre, while samples from the same source in early July contained only 30 per cent. It was found that it was disadvantageous to treat bracken with very dilute acid or very dilute alkali. Such treatment reduced the available protein and increased the fibre content.

The following table gives the results of analyses of untreated and treated bracken fronds. In this case dilute alkali was used :—

TABLE II.

RESULTS OF ANALYSIS OF MOISTURE-FREE BRACKEN.

Constituent.	Untreated. Per cent.	Treated. Per cent.
Ether Extract	1·00	0·47
Protein	14·07	8·23
Soluble Carbohydrates	42·42	35·00
Fibre	35·78	50·29
Ash	6·73	6·01
	<u>100·00</u>	<u>100·00</u>

It will be seen from Table II. that there is a distinct loss in protein when bracken is treated with dilute alkali. There

is a decrease in the amount of carbohydrates and an increase in the amount of fibre. It was found that the proportion of ash was very high in fronds collected at the end of April (11·3) when compared with ash from fronds collected in October (6 per cent).

The proportion of protein is highest in April (25 per cent) and lowest in October (7 per cent).

A complete table of results will be given when the investigation is completed. Bracken fronds will be collected every month from April onwards and an analysis made for nutritive constituents. Portions of the samples will be used to make a chemical analysis for the presence or absence of poisonous constituents or constituents which would be injurious to live stock.

APPENDIX I.

REFERENCES TO BRACKEN.

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- 1903. Vol. XV., pp. 446-447. Question of finding a practical method of destroying bracken.
- 1903. Vol. XV., p. 449. Bracken on hill grazings. No need for further investigations for means of combating the plague. The only effective means of combating the plague is cutting young undeveloped plants in early June.
- 1903. Vol. XV., p. 452. Prizes are offered for machines for cutting bracken.
- 1905. Vol. XVII., p. 482. Trials for machines for cutting bracken abandoned.
- 1915. Vol. XXVII., p. 54. Bracken sickness in cattle—Dr G. S. M. M'Gowan.
- 1916. Vol. XXVIII., p. 92. Bracken Life History and Eradication by G. P. Gordon, B.Sc. Sulphuric Acid spraying effective.
- 1919. Vol. XXXI., p. 227. Bracken Rhizomes and their Food Value—Professor James Hendrick.
- 1934. Vol. XLVI., p. 520. Motion requesting Government to include eradication of bracken under Land Improvement Scheme.
- 1934. Vol. XLVI., p. 522. Letter from Earl of Dalkeith.
- 1935. Vol. XLVII., p. 432. Resolution by Mr Ian M. Campbell not adopted.
- 1935. Vol. XLVII., p. 441. Request by Blackface Sheep Breeders' Association to support appeal for Government aid not granted.
- 1935. Vol. XLVII., p. 453. Question raised at General Meeting.
- 1936. Vol. XLVIII., pp. 426-427. Representatives appointed to attend a Conference.
- 1936. Vol. XLVIII., p. 431. Letter from Mr Ian M. Campbell.

- 1936. Vol. XLVIII., p. 441. Letter requesting Government aid.
- 1936. Vol. XLVIII., p. 441. Representatives appointed to co-operate with other bodies.
- 1936. Vol. XLVIII., p. 448. Report of Meeting with Secretary of State for Scotland.
- 1937. Vol. XLIX., p. 453. Copy of Government Scheme submitted.
- 1937. Vol. XLIX., p. 457. Committee appointed to consider Scheme.
- 1937. Vol. XLIX., p. 469. Report by Committee.
- 1937. Vol. XLIX., p. 469. Emendations of Scheme recommended to Government.
- 1937. Vol. XLIX., p. 473. Resolutions adopted at Joint Conference.
- 1937. Vol. XLIX., p. 478. Resolutions not adopted by Government.

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- 1. Hendrick—Bulletin of Miscellaneous Information, No. 4, 1921, XVI. The Composition of the Rhizomes of Bracken, &c.
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- 4. Der Forschungsdienst, 1938, Vol. V., p. 86. Schriftums—Nachweis, Band 5, Heft. 1.
- 5. Winton, Vol. 2, pp. 178-179. J. Wylie & Sons, 1935.
- 6. Scottish Journal of Agriculture, July 1940, Vol. XXVII., No. 1, pp. 31-36.
- 7. Journal of the Ministry of Agriculture, June 1940, Vol. XLVII., No. 1, pp. 55-62.
- 8. Hendrick—"The Composition of the Rhizomes of Bracken and its Variations."
- 9. Braid, Vol. XIX., Scottish Journal of Agriculture, 1936.
- 10. Muller, Land wirtenschaftliche. Giftlehre, 1897, p. 29.
- 11. Journal of Comparative Pathology, 1893, p. 278.
- 12. Veterinary Toxicology, Second Edition, pp. 284-285.
- 13. Veterinary Record, 1935, Vol. XLV., pp. 1067, &c.
- 14. Veterinary Record, July 1940, Vol. LII., No. 27, p. 499.
- 15. Journal of Comparative Pathology, Vol. 30-31, p. 311.
- 16. Veterinary Journal, 1920, p. 98.
- 17. Kerdiles, Revue generale de médecine vétérinaire, 15 janvier 1929.
- 18. Lominet and Lavielle. Intoxication de Bovins par la fongère aïgle. Recueil de Médecine Vétérinaire, Vol. CXII., 1936.

INSECT AND OTHER PESTS OF 1940.

By A. E. CAMERON, M.A., D.Sc., F.R.S.E.,
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PERHAPS the outstanding entomological feature of 1940 was the marked abundance of the Large Cabbage White Butterfly (*Pieris brassicæ*), which was widespread throughout Scotland and was accompanied by smaller numbers of the Small White Butterfly (*Pieris rapæ*) and the Green-veined White Butterfly (*Pieris napi*). Reports of damage to crucifers in garden and field by the caterpillars of the first two came from different parts of the country. Another injurious caterpillar was that of the Ghost Moth (*Hepialus humuli*), which bores into potatoes. In contrast with recent years, specimens of the caterpillars of the Death's Head Moth (*Acherontia atropos*), as judged by the number of inquiries and specimens sent in for identification, were more numerous in potato fields. The Rosy Rustic Moth (*Hydræcia micacea*), which was discussed in the 'Transactions' of 1938, continues to be an important pest of potatoes grown on allotments, and was also recorded as destructive to sugar-beet in Fifeshire.

From Balquhiddy, Perthshire, there came a report of damage to lawns and pastures by the grub of the Garden Chafer or Bracken-Clock (*Phyllopertha horticola*). Another beetle which attracted attention was the Turnip and Cabbage Root Gall Weevil (*Ceuthorrhynchus pleurostigma*), causing unsightly swellings on the roots of young brassica transplants. In view of the large acreage of permanent grassland that has been brought under the plough in response to the demand for increased food production by farmers, it was only to be expected that cereal and potato crops following upon old grass would suffer some measure of damage by wireworms and leather-jackets. Such proved to be the case, but loss that was attributed to wireworms was sometimes proved to be due in whole or in part to deficient soil consolidation.

For the second year in succession the Mealy Cabbage Aphis (*Brevicoryne brassicæ*) and the Potato Aphis (*Myzus persicæ*) were excessive on cruciferous crops in the Lothians. In some localities beans were so heavily infested by the Bean Aphis (*Aphis fabæ*) as to be practically smothered and destroyed. Although the Carrot Aphis (*Cavariella aegopodii*) was fairly prevalent, it did only slight damage, and it seems that carrots

can tolerate moderate infestations of this aphid without suffering serious harm.

The perennial scourge of the root-infesting maggots of the Carrot Rust Fly (*Psila rosa*), the Cabbage Root Fly (*Delia brassicae*), and the Onion Fly (*Delia antiqua*) was again in evidence, but recent investigation has shown that 4 per cent calomel dust is an effective controlling agent of the two latter pests.

In recent years practically all the complaints of damage to potatoes by the Root Eelworm (*Heterodera schachtii*) have come from allotment holders. Destruction of the infective cysts in the soil by the application of chemical agents has engaged the attention of several investigators, but the cost of treatment with any of the materials so far tried renders the method impracticable.

CABBAGE WHITE BUTTERFLIES.

There are three kinds of Cabbage White Butterflies, which are known to every student of natural history and are familiar objects wherever cruciferous crops are grown. They are known respectively as the Large White (*Pieris brassicae*), the Small White (*Pieris rapae*), and the Green-veined White (*Pieris napi*). Their simple colour-patterns of white, relieved by a few dark round spots, dashes, and marks are sufficiently distinct for each to make them readily identifiable by means of the accompanying illustrations (Figs. 4, 7, and 8).

Food Plants.—The Large and Small Whites feed and breed chiefly on cabbage and swedes, but are also found on turnips, broccoli, brussels sprouts, cauliflower, and kale. The Green-veined White, on the other hand, is rarely found on cabbage, and seems to prefer garlic mustard and hedge mustard.

Life-history.—The habits and development of the three Cabbage Whites are so much alike that they may be conveniently discussed together. Heretofore, it has been generally accepted that they produce only two generations per year, but recently Richards¹ has shown that annually there are three complete generations of the Small White and a partial fourth.

During the winter, Cabbage White Butterflies remain as dormant chrysalids in crevices of walls, fences, or other suitable shelters fastened securely to the substratum by a group of hooks, which arise from the hind-end and are firmly

¹ Richards, O. W. (1940). "The Biology of the Small White Butterfly (*Pieris rapae*), with special reference to the factors controlling its abundance." Jour. Anim. Ecol., Vol. IX., No. 2, pp. 243-288.

engaged by the fibres of a silk pad spun on the supporting surface by the caterpillar before changing to a chrysalis. An additional attachment is provided by a slender embracing girdle also of silk.

From the chrysalids the butterflies emerge in May, and soon proceed to lay their ribbed, yellow eggs on end on the



Fig 4. — *Pieris brassicae*. *Large Cabbage White Butterfly*. Male (above) and female $\times 1\frac{1}{2}$.

From nature.

under surface of the leaves of their food plants. Those of the Large White are laid in clusters of thirty or more, whilst those of the Small and Green-veined Whites are deposited here and there singly.

Hatching of the eggs occurs in six to eight days, and the resulting caterpillars moult four times in the period of four

weeks that is devoted to their feeding and growth, and each of the five stages lasts about five days.



Fig. 5.—*Pieris brassicae*. *Large Cabbage White Butterfly*.
Full-grown Caterpillar. $\times 2\frac{1}{2}$.

From nature.

The full-grown caterpillars of the Small White and the Green-veined White are an inch long and resemble each other in the dull velvety-green colour of the body, which is finely speckled with black dots and marked with a row of yellow spots along each side. The mature caterpillar of the Large White (Fig. 5) is larger, $1\frac{1}{2}$ in. long, and sparsely covered with short hairs which arise from small warts. The upper side of the body is bluish-green, marked with dark spots on each side and traversed along its length by a median yellow stripe, and a similar one on each side. The yellow side-stripes are also present in the Small White and the Green-veined White, but the latter lacks the yellow stripe down the middle of the back, which is present in the Large and Small Whites. With the transformation of the caterpillars to chrysalids (Fig. 6), which are greenish, spotted with black, and the later emergence of the butterflies, the first generation is completed in about six weeks and the cycle repeated a second and a third time, when breeding for the year ceases with the dormant chrysalids.

Fig. 6.
Pieris brassicae.

Large Cabbage White
Butterfly. *Chrysalis*.
 $\times 2\frac{1}{2}$.

From nature.

Correlated with the fact that the eggs of the Cabbage White are laid in clusters is the habit of the young caterpillars. They are notably gregarious, but as they grow they lose their social habit and scatter over the leaves of their food plant.

Migration.—Both the Large and Small Whites have pronounced migratory habits, and the progressive seasonal increase in the numbers of the butterflies in the years of their abnormal abundance may be partly due to immigrants, which fly to Britain from the Continent. In intervening years when there is no migration the Large White is conspicuous by its scarcity. Such was far from being the case in 1940, when this and the Small White were so common that it might well be recorded as a "Cabbage White" year.

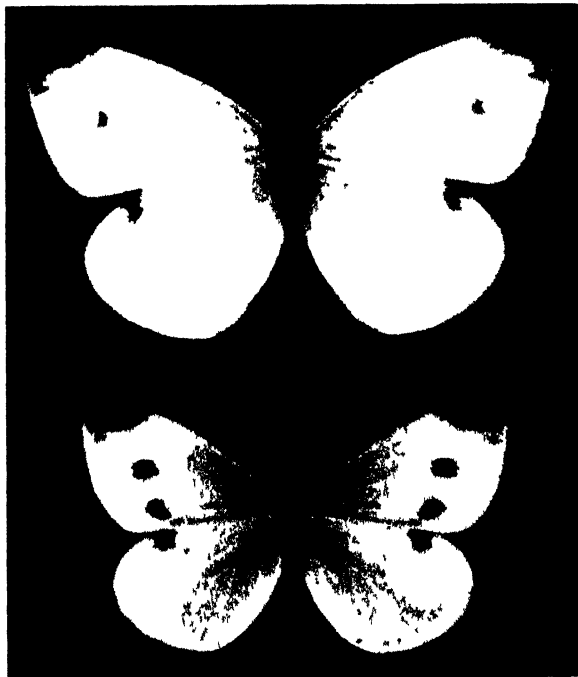


Fig 7. —*Pieris rapae* Small Cabbage White Butterfly
Male (above) and female. $\times 1\frac{1}{2}$

From nature

Reference to the unusual density of the population of Cabbage Whites and their migratory habit was made by the writer of a short note contributed to *The Scotsman* of 17th August 1940. The author commented that one of the largest flights of white butterflies that he had ever seen had recently occurred near Edinburgh. The picture of the butterflies can best be described in the author's own words: "There must have been millions of the insects. So dense were their numbers for a few minutes they appeared like a snowstorm."

The insects enveloped a train as it passed, and the passengers could be seen standing at the windows obviously interested in the drifting white company. Butterflies plastered the engine, and fluttered along the carriage sides. The draught of the train swept thousands of them along the track, and after the train had passed they still fluttered in their tens of thousands over the railway." Continuing, the writer stated: "One has heard that the 'Cabbage White' has been a great pest in several districts this year, and that vegetable growers have taken special precautions to deal with them and their

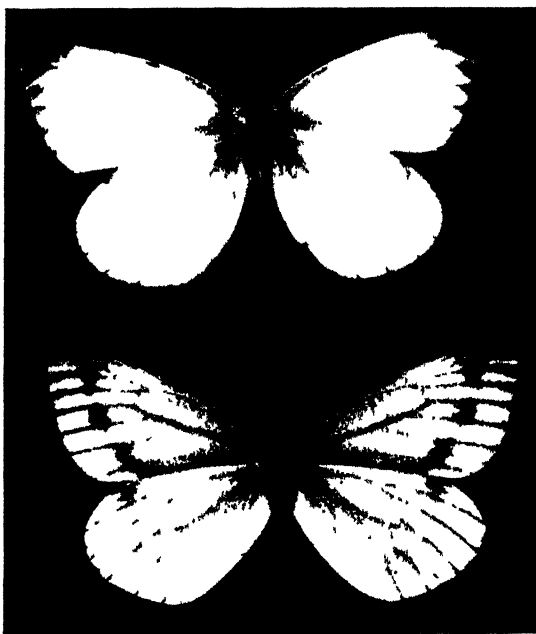


Fig. 8.—*Pieris napi*. *Green-veined White Butterfly*.
Male (above) and female. $\times 1\frac{1}{2}$.

From nature.

caterpillars. . . . I have heard of dense clouds of butterflies being observed by seamen far out at sea. Never before have I seen a host of them to equal that which I saw spreading over the Lothian fields this week."

On 17th August 1940, the day on which the flight of the Cabbage Whites was recorded in *The Scotsman*, I happened to be walking on the Ochil Hills, east of Dunblane, and there I observed a protracted flight of the Large White Butterfly at elevations of 400-600 feet. For about an hour during the late forenoon, the butterflies were seen flying across a pasture

and over a beech hedge bordering a road. The majority maintained a course from the north west to the south-east over the Ochils, but many individuals, diverted by attractive flowers and cruciferous field crops, flew without reference to



Fig. 9. *Pieris brassicae* - Caterpillars of Cabbage White Butterfly on a cabbage leaf

11 mmature About natural size

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any particular direction. On subsequent days, during the third and fourth weeks of August, the same general trend of migration from north west to south-east was maintained by butterflies observed in flight near the Allan Water at Dunblane.

Damage.—As was to be expected from the foregoing account of the abundance of White Butterflies, reports of damage to cruciferous crops came from many localities. On hatching, the young caterpillars feed on the lower epidermis of the leaves, but with increased growth they eat the entire blades, leaving only the stalks and veins (Fig. 9). In cabbage the caterpillars pass to the heart to feed on the tender leaves, where they are not only difficult to reach with insecticides, but make themselves obnoxious by fouling the plant with their excrement.

Natural Enemies.—Towards the end of the summer an increasing number of Cabbage White caterpillars are attacked by parasites. The ones most frequently encountered are the Braconid wasps *Apanteles glomeratus* and *A. rubecula*, of which the former prefers the Large White and the latter the Small White. These parasites lay their eggs inside the bodies of the host caterpillars, and there may be as many as 150 parasitic maggots in a single caterpillar. When full grown they bore through the skin of the caterpillar to the outside, where they spin their bright yellow cocoons in clusters, that adhere to the skin of the dying host.

Control.—In gardens and allotments Cabbage Whites are most economically and expeditiously controlled by collecting and destroying, first, the eggs and, later, the caterpillars. A cheap but effective spray is a solution of soap or salt, made by dissolving 2 to 3 oz. of one or the other in a gallon of water and applied by means of a knapsack spraying machine in quantity sufficient to drench the attacked plants.

THE GHOST SWIFT MOTH (*Hepialus humuli*).

The Ghost Swift Moth (Fig. 10) is essentially a grassland insect, and its subterranean caterpillar, which is more commonly met with than the moth itself, is frequently brought to the surface with other soil insects such as wireworms, leather-jackets, and chafer grubs, when old or derelict grass is ploughed. In the large acreage of grassland recently brought under cultivation to meet war-time demands for greater food-production, the caterpillar has not failed to attract attention, not only because of its numbers and appearance, but also because of the damage it does to subsequent crops.

Food Plants.—The caterpillar is a general root-feeder and can subsist on the slender roots of grasses equally with the more substantial roots of weeds like docks and dandelions. In gardens and nurseries it attacks the roots of all kinds of

herbaceous plants and has been found boring in corms, bulbs, tubers, and rhizomes. On the farm it has been recorded from cereals and potatoes, and also from a wide selection of market-garden crops.

Life-history.—The *moth* (Fig. 10) has a wing-expanse of $1\frac{1}{2}$ to $2\frac{1}{2}$ in. In the male the wings are silvery-white, whilst those of the female are yellowish-brown with reddish



Fig 10. *Hepialus humuli*. *The Ghost Moth*. Male (above) and female. $\times 1\frac{1}{2}$.

From nature.

markings. The moths fly at dusk during June and July, and the female in the course of her flight drops her eggs singly over grass or other vegetation as does the Antler Moth.¹ The incubation period is about two weeks, during which the eggs change their colour from white to black.

The *caterpillar* (Fig. 11), on hatching, begins to feed on the rootlets of plants, but in its early stages it is not apparently

¹ Cameron, A. E. (1938). "Insect and Other Pests of 1937." Trans. H'ghl. Agr. Soc., Vol. L, p. 98.

committed to a subterranean existence. Quite young caterpillars, no bigger than $\frac{1}{2}$ in. long, have been found above ground in March amongst the grass of upland grazings, where they were swept up with newly hatched larvæ of the Antler Moth. The growth of the young caterpillar is extremely slow, since in the nine months that had elapsed since hatching they had attained a size of barely more than half an inch. The fact that caterpillars of markedly different sizes co-exist at all seasons of the year suggests that the life-cycle requires more than one year. In 1940 specimens recovered from a piece of grassland, which was being prepared for cropping, were of three distinct sizes—namely, $\frac{1}{10}$ in., $1\frac{1}{2}$ in., and 2 in. Specimens as long as 2 in. I have collected in February, and others of $1\frac{1}{2}$ in. in February, so that there would appear to be no increase in size during the autumn and winter months. From

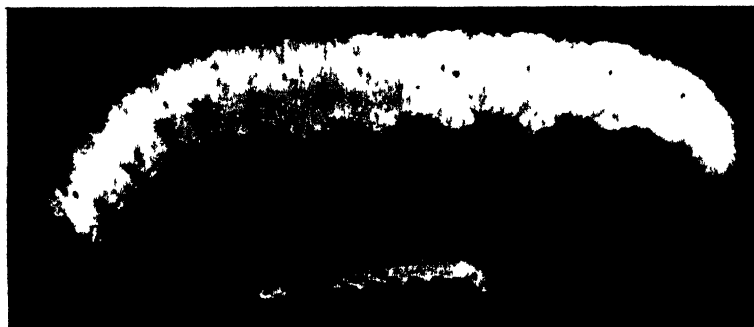


Fig 11.—*Hepialus humuli*. Full grown and first stage Caterpillars. $\times 2$

From nature.

the foregoing facts it is evident that the life of the caterpillar is at least two years.

The caterpillar of the Ghost Swift Moth is white with a few sparsely-distributed black bristles and the spiracles black. The head is reddish-brown, and the first body-segment bears a yellowish shield. The thoracic legs are yellow, each ending in a single black claw. The spiracles are oval in shape and black. The caterpillar reaches full growth in April or May, when it is then $2\frac{1}{4}$ in. long.

The brown *chrysalis* into which the caterpillar changes occurs in the soil or in burrows in roots previously made by the caterpillar. By means of small spines on its body, the pupa pushes itself up to the surface of the soil, when the moth is ready to emerge.

Damage.—The caterpillars sometimes damage pastures and

lawns by destroying the roots of grasses. In gardens they do injury to herbaceous plants in beds and borders, to strawberry and raspberry as well as vegetables. In late summer and autumn they bore into potatoes and render them unmarketable. This latter kind of damage is especially likely to occur in a crop that has succeeded old and weedy grassland, and the majority of the reports of damage that came to hand in 1940 had reference to potatoes grown in the first year after grass.

Control.—Since the greatest risk of damage to crops is likely to occur in newly broken grass and waste land, planting should be postponed if possible for a year until the ground is



Fig. 12 —*Acherontia atropos* The Death's Head Hawk Moth
Slightly reduced

Reproduced from Trans. Highl. Agric. Soc. Vol. XXVI, 1914

thoroughly cleaned. In gardens crude naphthalene may be applied at the rate of 2 to 3 oz. per square yard and thoroughly mixed with the soil at the time of digging.

THE DEATH'S HEAD HAWK MOTH (*Acherontia atropos*).

This handsome insect (Fig. 12) enjoys the distinction of being the largest moth in the British Isles, where it occurs from north to south. From tip to tip of the outspread wings it measures $4\frac{1}{2}$ to 5 in., whilst the length of the stout body is $2\frac{1}{2}$ in. The colour scheme is one of brownish-black and orange with red, and is sufficiently striking to make the insect readily recognised. The fore-wings are blackish, suffused with red in places, and crossed by zigzag narrow black lines.

The hind-wings are orange, with the veins black, and two broad parallel black bands near the outer margin. On the upper side of the thorax there is a prominent reddish-yellow blotch like a skull and crossbones, from which the moth has earned its popular name. The sides of the hind part of the body are coloured orange, contrasting sharply with the broad black stripe, which runs down the middle of the back.

The *moth*, which is by no means common, is highly interesting, not only because of its size but also from its habits. Among sound-producing insects it is unique in the method by which its shrill note is evolved. The noise is said to be the result of the forcing of air through the proboscis. No explanation, however, has been made as to where the required air comes from. Another of its distinctive habits is that of entering beehives in order to obtain honey. On 13th July



Fig. 13 — *Acherontia atropos* — *The Death's Head Hawk Moth.*
Full-grown Caterpillar.

About natural size

Reproduced from Trans. Highl Agric. Soc., Vol. XXVI, 1914

1939 a specimen of the moth was sent to me from Cupar, Fifeshire, where it had been found alive inside a beehive three days previously. The moth must have entered by the door, passed under the sheet covering the honey, and come to rest between the outer and inner wall. In the 'Transactions' of 1916, MacDougall recorded the recovery of a dead specimen in March from a hive in Kirkeudbrightshire. The occurrence of the moth in hives has been recorded sufficiently often to warrant the supposition that the habit is a fixed one and not due to mere chance.

The caterpillar and the chrysalis are much more frequently encountered than the adults, and in my own experience they have always been found in potato fields, or in gardens and allotments where potatoes were being grown.

The *caterpillar* (Fig. 13) is no less striking than the moth.

When full grown it is almost 5 in. long and is either green or purplish. On either side of the body there are seven purplish stripes with yellow margins, that slant upwards and backwards. A stout rough spine projects back from the upper side of the second last body-segment. The caterpillar feeds on potato leaves, and when full grown enters the soil to a depth of two to four inches. There it makes for itself a cavity with smooth walls and transforms to a chrysalis in a week or two. The chrysalis is brownish-black and measures $2\frac{3}{4}$ in. long by $\frac{3}{4}$ in. broad at its widest part. At the hind-end there is a short, rough spike.

There are years when the Death's Head Hawk Moth is either absent or very rare. In 1933, and also in 1934, specimens of the caterpillar and chrysalis were fairly frequently found in Midlothian, East Lothian, Berwick, and Roxburgh. From 1935 to 1938 there was no word of the insect in Scotland. In 1939, again, I had reports of its presence in Midlothian, East Lothian, Berwickshire and Fife, and in 1940 it cropped up afresh in the first three of these counties. It will, of course, be understood that the above records only refer to specimens of which I had actual knowledge, but they could no doubt have been supplemented from other parts of the country. According to the records, the caterpillars were found from July to October and most often in August. The chrysalis occurred from August to October and the adults in July. In England, the adult has been found as early as May, and South, in his 'Moths of the British Isles,' Series I., p. 26, relates that a moth was captured on board a ship in the North Sea on 28th April 1903. It is suggested that precocious specimens of the moth in May and June are possibly immigrants to Britain from the Continent, since the moths have often been observed at sea long distances from land.

THE ROSE RUSTIC MOTH (*Hydraxia micacea*).

In the 'Transactions' of 1937 I reported that the caterpillars of this moth (Fig. 14) had been very destructive to potatoes in gardens and allotments in the summer of 1936. In 1938 there were few reports of its activities, and in 1939 not a single case of damage came to my notice. The insect must, therefore, have been comparatively scarce. In 1940 the caterpillar was again common in the South of Scotland.

The moth normally lays its eggs in weedy grassland, and the caterpillar burrows into the stems of dock, plantain, valerian, couch-grass, horse-tail, and sedges. When infested ground is dug or ploughed and planted with potatoes, the caterpillars deprived of their usual food-plants migrate to the

only ones available. They enter the stem of the potato at soil level and excavate the interior, with the result that the damaged stem flags and withers. In severe infestations as much as 10 per cent of the plants are affected. There is no method of control apart from the removal of attacked stems and destruction of the caterpillars.

The damage always becomes apparent in June, when the caterpillars are approaching their full growth. Ground that is continually cropped rarely becomes infested, since it is the habit of the moth to return to weedy land to lay its eggs.

Potatoes are not the only cultivated crop which the caterpillar attacks. In June it was found working in trial plots planted with sugar-beet in Fifeshire. The majority of the caterpillars were burrowing in the crown, but there were some which bored into the root from below. On an area of



Fig. 14.—*Hydrucia micacea*. *Rosy Rustic Moth*.
From nature. Slightly enlarged.

one and a half acres kept under observation damaged plants amounted to about 3 per cent.

THE GARDEN CHAFER OR BRACKEN-CLOCK (*Phyllopertha horticola*).

In Scotland the Garden Chafer is usually found in upland pastures and in lawns. In September 1940 a heavy infestation of the grub of this beetle was reported from the shores of Loch Voil, Perthshire, where examination showed that the grub population was about a million and a half per acre in a garden lawn. During the past twenty-five years the insect has been recorded as destructive in Scotland on two other occasions, the one by MacDougall in the 'Transactions' of this Society, 1916, and the other by Meikle and Macfarlan,¹ the localities concerned being in Ayrshire and Dumbartonshire

¹ Meikle, A. A., and Macfarlan, J. (1933). "Damage to Pasture by the Larvae of the Bracken-Clock." Scot. Jour. Agric., Vol. XXI., pp. 183-185.

respectively. An earlier outbreak at Killin, Perthshire, in 1900 was recorded by MacDougall in the 'Transactions' of 1901.

Life-history.—The *adult* (Fig. 15) is about $\frac{1}{2}$ in. long and about twice as long as it is broad. The head and thorax are a glossy bluish-green, and the wing-covers reddish-brown.

The beetle first appears on the wing in June, when it creeps out of the ground, where the grub and pupa have spent the winter and spring. Sometimes the beetles occur in swarms, the extent of which is determined by the degree in which the locality had been infested by the grubs. The food of the beetle consists of the foliage of fruit trees, bushes of small

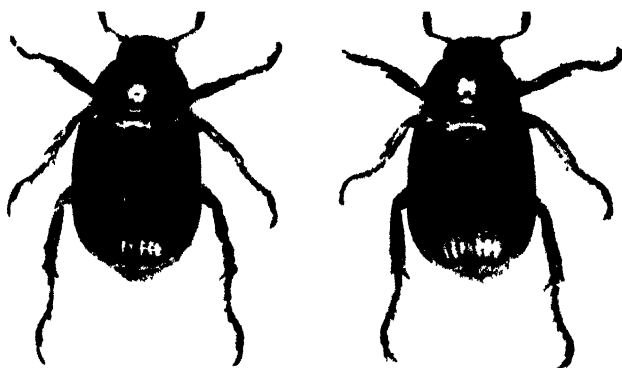


Fig. 15.—*Phyllotreta horticola*. *The Garden Chafer*
or *Bracken Clock*. $\times 3$.

From nature.

fruits, such as raspberry and blackberry, also strawberry, and such unrelated plants as dock, clover, bracken, and rose. Of bracken they eat the tender unfolding fronds, and of roses, to which they are especially attracted, they devour both the leaves and the flowers.

The *eggs* are laid singly in the soil, into which the beetles burrow for a distance of two to four inches.

The *larva* or *grub* (Fig. 16) hatches in two to three weeks and begins to feed on the fibrous roots of grasses. Growth proceeds fairly rapidly during the summer and early autumn, but is arrested in October, when the grub enters hibernation and becomes dormant. By this time it has entered its third and final stage. Of the two previous stages the first lasts for two to three weeks and the second three to four. The third stage, on the other hand, is prolonged to seven or eight months.

Feeding ceases in October, when the grub leaves the root-zone and makes for itself an oval cavity, in which it passes the winter.

The characters by which the grub can be recognised are fairly easy to discern. The head is shiny brown and bears a pair of moderately long antennae and a pair of stout jaws. The body is markedly curved, creamy white and wrinkled, measuring about 1 in. expanded, including the head. There is a pair of well-developed legs on each of the first three body-

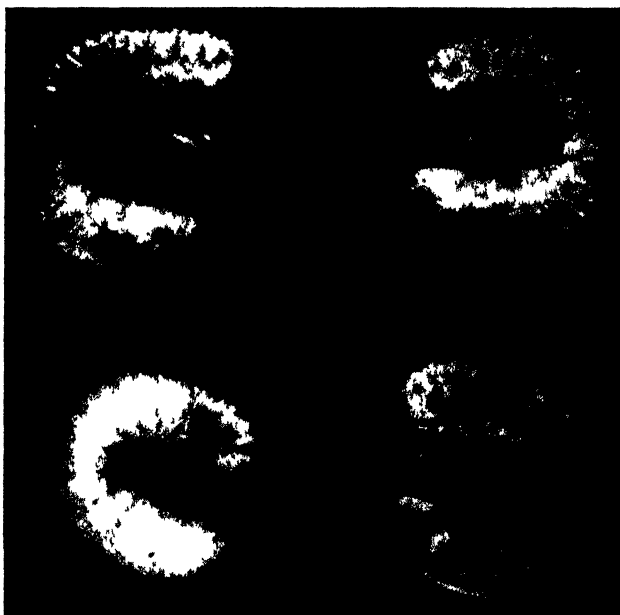


Fig. 16.—*Phyllopertha horticola*. The larva or grub of the Garden Chafer or Bracken Cuckoo. $\times 2\frac{1}{2}$

From nature.

segments, increasing in length progressively from the first to the third. The body is sparsely clothed with pale yellow bristles, except on the folds of the upper side of abdominal segments 1 to 7, where they are shorter and more numerous. Especially characteristic of the Garden Chafer grub are the bristles and spines on the under side of the large, last segment. On either side of the middle line there are two parallel rows of short, sharply pointed, dark-brown spines, about twenty in each row. Behind, and at the sides of the rows there are about three dozen brown, flat bristles with their ends blunt and curved backwards.

The *pupa* is found in May in the cavity previously occupied by the grub. Indeed it rests in the moulted larval skin. The pupal period lasts for thirty to forty days.

From the above description it is evident that the life-cycle is completed in one year, and there is, therefore, only one generation per annum.

Damage.—The amount of damage of which the grub is capable depends on the density of its population. In Somerset, Walton¹ recorded a million per acre in two severely damaged hayfields, and in the infestation investigated by Meikle and Macfarlan (*loc. cit.*) in 1938 in Dumbartonshire at Loch Lomond, an estimate of 435,000 per acre in a damaged pasture was made, whilst in a lawn at Loch Voil the density was calculated to be about 1½ million per acre. A random sample yielded about 300 per square yard. In cases of heavy infestation the turf is so thoroughly undermined as to become spongy and resilient to the tread. Owing to the deterioration of the grasses, cattle and sheep avoid damaged areas, and there is, therefore, a serious reduction in the quality as well as in the quantity of the grazing.

It should be noted that the first indication of the presence of the grubs in the soil is the attention paid to infested ground by crows. In searching for the insects the birds pull up the loose grass, which is left in detached tufts here and there, giving the lawn or pasture a very unkempt appearance.

Control.—Several methods have been recommended for reducing infestations of the Garden Chafer, one of which is directed against the adults, the others against the grubs. Since the beetles often feed on the foliage and flowers of plants in great numbers, they may be captured by shaking the infested plants, so that the beetles fall on a sheet spread on the ground, where they can be readily gathered and appropriately dealt with. A device consisting of a wide-mouthed scoop attached by its narrow end to a box was introduced by Taylor and Thompson² for the same purpose.

The grubs can be dealt with by ploughing the infested ground in order to expose the grubs to birds. Alternatively, the ground could be rolled in October to consolidate the ground and crush the larvæ.

Dressings of crude naphthalene at the rate of 2 cwt. per acre may be applied to affected lawns and pastures in September or October. The treatment is more effective if made just prior to rain; otherwise it is advisable to soak the ground

¹ Walton, C. L. (1934) "Control of *Phyllopertha horticola* in Grassland." Rep. Agric. Hort. Res. Sta., Bristol, pp. 150-157.

² Taylor, T. H., and Thompson, D. W. (1928). "A Garden Chafer Attack." Ann. App. Biol., Vol. XV., p. 258-262

with water so that the naphthalene may get a chance to penetrate to the zone inhabited by the grubs.

POTATO EELWORM (*Heterodera schachtii*).

Since some time prior to 1917 the Potato Eelworm has been known as a pest of the potato crop in Scotland, and with the passage of the years it has gradually spread, making its presence particularly felt in early potato-growing districts and more recently on allotments. Light soils and continuous cropping provide the conditions which favour the maintenance or increase of the worm, but how and where it first gained a foothold in the country is one of those elusive problems that even science is powerless to solve. Across the Border it was first recognised in Yorkshire in 1917, since when it has become widely distributed wherever potatoes are grown.

Symptoms.—So uniform are the effects produced on the potato plants by the eelworm, that the name “potato sickness” denotes the disease caused by this organism and no other, and land that is infested by its cysts is said to be “potato sick.” Plants that are affected by potato sickness can be recognised by the following characters :—

1. Retarded or stunted growth, and dulness of leaf-colour.
2. Wilting and shedding of lower leaves, leaving the younger ones bunched at the top. A withered spot first appears at the tip of a leaflet, followed by others at the margin. Finally, all fuse, and withering extends over the whole leaflet, which shrivels up.
3. Development of fibrous or “hunger” roots just beneath the surface of the soil to replace the normal ones that are destroyed.
4. Distribution of the disease in patches throughout a field.

Diagnosis.—Identification of potato sickness rests on the recognition of the above characters and is readily confirmed by the cysts (Fig. 17) on the roots of affected plants or in the soil near the roots. The cysts, which are first white, later turning brown, represent the end-point of the life-cycle, and their nature will be readily understood from the account of the life-history which follows.

Life-history.—The brown cyst found in the soil is a convenient stage with which to begin the description of the life-cycle. Actually it is the dead body of the female worm, in which the skin has become thickened, hardened and

darkened, and the internal organs have disappeared. In shape it is either rounded or lemon-like, with the pointed head-end projecting slightly from the swollen body. Its diameter is about $\frac{2}{3}$ in.

The biological significance of the cyst is that it grants protection to the 600 odd eggs which occupy its interior. Instead of being laid they are retained in the body of the female, and in each a larva develops within the intact egg-membrane or shell. In the absence of young potato plants and their root excretion, the eggs in the cyst may remain



Fig. 17.—*Heterodera schachtii*. *The Potato Eelworm*. $\times 40$.

From nature. Two brown cysts, each replete with eggs, adhering by their slender heads to a potato rootlet.

dormant for as long as eight years. Nevertheless, hatching appears to proceed slowly, a few eggs each year, and the resultant larvæ perish from starvation. That such is the course of events is shown by the fact that the risk of damage to a crop from eelworm attack decreases with the length of the interval separating two successive potato crops in an infested field. Cysts, too, recovered from infested soil which has been rested from potato-growing, are frequently found, in which some of the eggs have hatched, leaving an unhatched remainder. It is because of this progressive decrease in the eelworm population that the recommendation is made that, on infected farms,

potatoes should be dropped from the rotation for four or five years in order to give the ground a chance to recover.

Strains of the Root Eelworm.—The potato is but one of the plants which is attacked by *H. schachtii*. It also occurs on wheat and oats, hops, sugar-beet, mangolds, and tomatoes. This faculty of the parasite to attack a variable range of host plants would appear to defeat the purpose of rotation as an agent of control, were it not that its selection of hosts is limited by the fact that it exists as different strains, each of which is confined to one kind of plant or to a few that are closely related to each other. For instance, the potato strain can infest tomatoes, but the potato and sugar-beet strains are not interchangeable.

Density of Population.—In a square yard of soil 6 in. deep it has been estimated that there may be as many as 100,000 cysts, and even if there were an average of no more than 200 eggs per cyst, the potential stock of eelworms ready to attack each plant in an infested field would run into thousands.

Damage.—The destructive effect of the Root Eelworm on the potato crop is expressed in terms of yield, which, in severe attacks, may be as little as two tons per acre. The tubers, too, may be so small as to be unmarketable. In this regard it should be noted that the potatoes of an affected crop are not themselves unhealthy, since the eelworm penetrates only the roots and not the tubers.

Mode of Dispersal.—Dissemination of potato sickness is entirely contrived by transference of the infective cysts from field to field or farm to farm. Under favourable conditions cysts may be distributed by wind- or water-carriage. They may, for instance, be drawn up into the air by strong wind currents and deposited here and there at random. Again, they may be washed out of an infested soil by heavy rain and carried by flood water from one field to another. A few may also be carried in soil attached to the boots of farm workers, the feet of horses and other farm animals, and agricultural implements.

The above methods are, however, of minor importance compared to the part played by the seed-tuber bearing cysts in the soil that adheres to its skin and so establishing new infestations in clean land. Another risk of introduction of the disease into clean land may arise from the cyst-bearing earth that collects in barrels and other containers used for the delivery of seed and ware between farmer and farmer, and farmer and merchant. In due course this infested earth

may be carelessly dumped on a clean field, when the containers are forwarded by a merchant to a farmer for refilling with potatoes.

Control.—1. *Preventive.*—Since cyst-bearing soil adhering to the seed-tubers is the most important vehicle of infection, they should be washed before being planted and the washings carefully disposed of away from clean land. It is particularly important that grassland, which is being brought under cultivation in order to increase the yield of food during the war, should be kept clear of infestation. By this same token dust from the bottom of barrels used for the transport of potatoes should be treated or disposed of, so that any cysts present may be rendered innocuous.

2. *Rotational.*—On land that is infested potatoes should be omitted from the rotation, if possible, for four or five years.

3. *Chemical.*—Soil-inhabiting pests are not readily controlled by chemicals, since they are relatively inaccessible, and chemicals must usually be applied in such large amounts as to render the cost of treatment prohibitive, not to mention the risk of seriously upsetting the balance of plant food-factors in the soil. Of many chemicals that have been tried, calcium cyanamide and the chloracetates of calcium and ammonium have apparently given promising results under experimental conditions. If chemicals act as plant stimulants rather than destroyers of the cysts and larvæ, they do not really offer a solution of the problem of eelworm control. Because of its properties as a fertiliser, calcium cyanamide would naturally increase the vigour of the young potato plants and so enable them to withstand, and grow away from, eelworm attack. Farmyard manure applied at the rate of 20 tons per acre will also do this very same thing.

4. *Trap-cropping.*—This method has for its aim the reduction of the cyst population by planting infested ground with a crop that is lifted before another generation of cysts arrives at maturity. In Ireland, Carroll,¹ in small plot experiments, planted two trap crops; the first in April was lifted in five weeks, and the second, which followed immediately, was lifted after three weeks. The results obtained appeared to increase the yield of a third crop planted the following season and would warrant further trials on a field scale.

¹ Carroll, J. (1939). "Experiments on Trap Cropping with Potatoes as a Control Measure against Potato Eelworm (*Heterodera schachtii*).", *Jour. Helminth.*, Vol. XVII., No. 2, pp. 101-112.

AGRICULTURAL RESEARCH IN SCOTLAND IN 1940.

BEING A BRIEF SUMMARY OF THE WORK AT THE
SCOTTISH AGRICULTURAL RESEARCH
STATIONS DURING THE YEAR.

*Readers desiring fuller information on any of the subjects mentioned
should write to the Director of the Station at which the investigation
is being carried out.*

INSTITUTE OF ANIMAL GENETICS.

UNIVERSITY OF EDINBURGH, WEST MAINS ROAD.

Cattle.—The breeding experiment designed to test the theory that the maternal grandsire has a greater influence on the milk production of granddaughters than the paternal grandsire has reached an interesting stage. Two groups of cows bred to show this difference are now in milk or coming on. It is not practicable to have all the cows calving and milking together, so that it is essential to maintain conditions as constant as possible—not an easy task at present.

Pigs.—The inbred line which is to serve for breeding experiments has exhibited low fertility, bad mothering, and low birth weights. Among the offspring kinky tails, black spotting, abnormal kidneys, deformed limbs, and split nostrils have occurred. Breeding sows are noisy and excitable. Here is a good illustration of the number and diversity of undesirable genetic qualities which may be latent in an apparently good stock. It is hoped soon to make studies of growth rate and food utilisation in the inbred pigs and their outcrosses.

The feeding of home-grown food-stuffs has become obligatory and the opportunity has been taken to compare results from kale, potatoes, swedes, and mangolds. The pigs lacked sufficient appetite for kale to make it worth while, except for tonic quantities. The other crops all gave reasonable results when fed with 3 lb. meal per head per day, but the

data in respect of appetite and food utilisation remain to be worked out. From the practical aspect, the potatoes were the most attractive.

Work with both pigs and cattle has been retarded during the year by difficulties arising from the shortage of both labour and feeding-stuffs. The long-term investigations have, nevertheless, been carried on as well as possible.

Poultry.—The moulting period in fowls varies greatly in individuals and increases in length as the bird ages. While it would probably have a deleterious effect on subsequent performance to eliminate the moult completely, the abbreviation of unduly prolonged non-productive periods would be advantageous. Attempts to do this by administration of various endocrine gland products were made during the autumn; preliminary results from one or two of the substances are encouraging, but further experimentation with these will be required during the next moulting season to find the best conditions for consistent results.

Despite wartime conditions it has been possible to keep our inbred genetical stocks going. The effect of changes in feeding and the lack of extended lighting during the winter on production is noticeable.

ANIMAL DISEASES RESEARCH ASSOCIATION.

MOREDUN INSTITUTE, GILMERTON, MIDLOTHIAN.

Louping-ill.—Louping-ill vaccine continues to prove successful in the control of the disease, and work is continuing with the object of evolving means for the simplification of its production.

Since the vaccine is not unattended with risk when applied to young lambs, it is hoped to obtain a safe and effective method of protecting these by means of a hyper-immune serum. Various types of sera have been produced and submitted to comparative tests, and an extensive, controlled field experiment is now proceeding.

Braxy.—Braxy vaccine has been issued for several years as a 'single dose vaccine,' and continues to prove highly effective as a means of controlling the disease. It should be noted, however, that on farms on which braxy is particularly virulent the vaccination may with advantage be repeated after an interval of fourteen days.

White Scour in Calves.—Previous investigations have shown that calves born from cows whose colostrum is deficient in

vitamin A. are predisposed to white scour; whereas calves receiving colostrum rich in vitamin A. are relatively insusceptible to the disease. It has been found, however, that no increase in the vitamin A. content of the colostrum can be effected when substances rich in vitamin A. or its precursor carotene (ood liver oil, grass silage, dried grass, or carrots) are fed to stalled cows during the winter.

In view of these results, an experiment is being carried out to ascertain whether the administration of a vitamin A. concentrate to newly born calves will increase their resistance to the onset of white scour and its allied affections.

Scrapie.—Since there has been obtained evidence that scrapie is due to an infective agent, an experimental hirsle has been purchased and is being maintained for the purpose of studying the cause and nature of the disease. Because of the prolonged incubative period of scrapie, the investigation must be a lengthy one.

Pine.—It has now been definitely established that in certain districts pine can be both prevented and cured by the administration of cobalt.

There have been carried out further experiments to determine whether the application to affected pastures of cobalt-rich manures would raise the cobalt content of the herbage and so prevent the disease.

In collaboration with the Macaulay Institute for Soil Research and the North of Scotland College of Agriculture, a series of experiments was carried out; these showed that the cobalt content of deficient pastures could be raised in proportion to the richness of the respective dressings of cobalt chloride, and that a dressing of 2 lb. per acre was sufficient to render such pastures cobalt adequate.

From the results of a later controlled experiment, it was apparent that such manurial treatment of cobalt-deficient land afforded means both for the prevention and cure of the disease.

Pulpy Kidney Disease in Lambs.—Severe losses are each year experienced from pulpy kidney disease. This affection attacks lambs during the first few weeks after birth and is due to a micro-organism closely related to that causing lamb dysentery.

An investigation of means for its prevention, particularly by the vaccination of the pregnant ewe, is being continued.

Cripples in Lambs.—As the result of a survey which was made in the spring of 1940 of the lamb mortality on tick-infested farms, it became evident that a considerable number of deaths resulted from joint-ill and other septic conditions,

and that these conditions were largely due to infection with a specific staphylococcus.

An extensive study of a number of strains of this organism is in progress with a view to obtaining a specific method of prevention.

Predigested Straw.—At the instance of the Agricultural Research Council, the Institute undertook to ascertain by indirect calorimetric measurements the starch equivalent of straw 'predigested' by the action of caustic soda. The results of this work tend to suggest that the starch equivalent of straw can be increased by 'predigestion,' but that the increase seems to depend on the other constituents of the ration.

Parasitic Gastritis in Lambs.—A study has been made of the effects of phenothiazine treatment on the worm burden, the weight, and the blood picture of lambs affected with parasitic gastritis. It was found that such treatment rapidly reduced the parasitic infestation and brought about a marked improvement in the condition of the experimental lambs. These effects could be closely correlated with changes in the constituents of the blood.

Grass Sickness in Horses.—During 1940 much intensive research on grass sickness has been carried out from the biochemical aspect. This work has particular reference to certain of the disease phenomena and was designed with a view to determining their origin and the nature of their development. Systematic chemical analysis of affected pastures has also been continued.

THE ROWETT RESEARCH INSTITUTE.

BUCKSBUEN, ABERDEEN.

Increased Food Production.—The Duthie Farm (about 670 acres) was reorganised for maximum food production. Pre-war output consisted almost entirely of animal products. In transferring feeding-stuffs into human food, there is a loss in energy value of from about 80 per cent in the case of dairy cows, to well over 90 per cent in the case of poultry and beef cattle. As the dairy cow is the most efficient transformer, and milk the most valuable animal product, milk production was increased by 30 per cent, but the production of other animal products was drastically reduced. The reduction in the number of animals kept released land which was devoted

to potatoes, oats, and fodder crops, some of which were sold as vegetables for human food.

It is estimated that by these means the output of food from the farm, reckoned in calories (total energy yielding value), was increased by over 100 per cent. Further, owing to the reduction in the number of animals and the fact that winter milk production was maintained mainly on silage produced on the farm, the amount of imported concentrates used was less than 25 per cent of the pre-war average.

A record of pre-war and post-war production, when completed and analysed, may be of value in connection with post-war reconstruction schemes if our food policy is to be based on nutritional needs, and home production maintained.

Grass Silage.—Since 1927 experimental work has been done each year on grass preservation for winter feeding. The experience gained in this work was applied to silage making. About 600 tons of silage was made in the summer of 1940 by the shallow pit method. The amount of wastage was negligible. Grass for the silage was cut three or four times at the stage of growth when it was of maximum nutritional value. About 10 tons per acre was obtained.

This silage, added to a maintenance ration of turnips, straw, and hay, has been fed to the herd of 80 milking cows at the rate of 20 lb. per gallon up to 3 gallons. Yields have been well maintained, and the colour of the milk is better than that obtained when the production ration consists of concentrates. It has been demonstrated on small groups of cows that a yield of up to 5 gallons a day can be attained on grass silage alone.

It has been shown that on farms where there is not the necessary equipment for dealing with three or four crops of grass silage from the same field in a season, good silage can be obtained from one cutting of the grass about a fortnight before it would normally be cut for hay, and the remaining growth can be used for grazing. About 5 tons per acre can be obtained from a single cutting.

Two conferences with farmers on grass silage and a number of demonstrations on the different methods were held at the Institute in co-operation with the North of Scotland College of Agriculture.

Potatoes for Poultry.—A number of experiments have been done on the replacement of imported by home-produced feeding-stuffs. The results of the experiments with dried grass were referred to in last year's Report. Long-term experiments have shown that potatoes can replace 35 per cent of concentrates in the ration of the laying bird without a reduction in egg yield. The potatoes must be boiled. They

are most palatable if made into silage after boiling, and stored for at least two or three weeks.

Fodder Yeast.—Yeast made from surplus carbohydrate materials and dried has been found to be an excellent substitute for ordinary dried brewers' yeast in poultry rations.

Value of Grazing for Pigs.—The herd of large white pigs was replaced by Wessex Saddlebacks, which are better grazers. In last year's Report it was stated that a saving of 35 lb. of food in 103 days was obtained by folding pigs over good summer pastures. The tests were extended to sows. Ten sows which got no supplement to good pasture after the weaning of the litters in the early summer until six weeks before the next farrowing in September, reared litters averaging 9.5 per sow. The litters at weaning were normal weight.

Pre-digestion of Straw.—In a six-months test with 7-cwt. bullocks fed on oat straw, roots, and a small quantity of concentrates, the average increase in the group receiving straw pre-digested with soda was 64 lb. more than the group fed untreated straw.

Other Work.—Some other work of less immediate practical importance was done for vitamin requirements and mineral metabolism.

THE SCOTTISH PLANT BREEDING STATION.

CRAIGS HOUSE, CORSTORPHINE, EDINBURGH.

Experimental work on the breeding of cereals, potatoes, herbage plants, swedes, and kales is in progress at the Station. Each year it is customary to describe briefly in the 'Transactions' one section of the work, and on this occasion the breeding of grain crops will be reviewed.

Oats.—The breeding of highly productive oat varieties, which will be resistant to lodging when grown on the more fertile soils and which possess other desirable characteristics, still continues to be one of the most important problems relating to the improvement of oats. A promising line along which this work has been proceeding has been to cross some short-strawed plants with certain of the heavy grain-yielding types with a view to obtaining in the offspring a combination of these two characters. Progress in this direction is being made, but fixed types are not yet available. The short-strawed Semi-dwarf oat has been largely used as a parent,

and the results so far obtained indicate that breeding with this oat deserves further investigation. The varieties Early Miller and Elder, both of which have a good type of straw, have also been used as parents.

Comparisons are also being made of several series of early-maturing hybrid selections, some of which it is hoped may prove to be adapted to poorer soils and upland areas. Some of these early-ripening selections reach maturity at Corstorphine about a fortnight earlier than the varieties Potato and Sandy. A defect, however, of many very early-ripening varieties is that their yield of grain is too low. Efforts are being made to see how far combination of high grain yield, early maturity, and hardiness for Scottish conditions can be secured.

Frequently in late districts, when the weather is wet and unfavourable at harvest time, considerable loss occurs through sprouting of the oat grain in the stook. Attempts are being made to produce an oat for general cultivation, which is resistant to sprouting at harvest time, through crossing the wild oat, *Avena fatua* (the grain of which does not readily sprout for some time after it is ripe), with certain cultivated varieties. Selected hybrid plants are tested for resistance to prompt germination at harvest time each year so as to ascertain which plants possess the character or are breeding true for it.

Small elite stocks of Early Miller and Bell oats continue to be grown at the Station, and there has always been a good demand for the seed of these varieties. Efforts are being made to see whether both of these varieties can be improved by further selection.

Barley.—Several years ago single plant selections were made from a crop of Scots Common barley, a variety which is widely grown in various parts of the North of Scotland. After comparisons of these were made over several years, it was decided that one of the selections which seemed better than the others should be increased in quantity. This new selection is now being tried in the North of Scotland, that being the area for which it was required. Scots Common barley has been crossed with Plumage Archer in an attempt to obtain a type of Common barley with the good quality grain and the standing capacity of Plumage Archer. Attempts are also being made to improve the grain quality of Scots Bere by crossing, and, if possible, to produce forms less liable to 'neck.'

For many years attempts have been made by plant breeders to induce hereditary variation in plants by treatment with various chemicals. The alkaloid, colchicine, may, under certain conditions, affect the hereditary mechanism—the chromosomes—in plants (increasing the number of chromosomes and

forming a plant known as a polyploid), and consequently produce variations of the plants which may be of importance. Various workers have been successful in inducing polyploidy in a range of plants by treatment with this chemical. Acenaphthene, another chemical, has also been used to obtain similar results. Such treatment may result in the establishment of lines of plants which are larger and more vigorous than those from which they were developed, or it may extend the range of variation available to the plant breeder.

At Corstorphine this work of inducing variation by chemical means has been concentrated mainly on barley. Only one or two workers have yet reported successful treatment of cereals with colchicine. Considerable difficulties have been encountered in the application of the treatment to these plants. Various methods of treatment with colchicine have been tried on an extensive scale over a period of some years at Corstorphine. Analysis of the material treated during the 1940 season has shown that new polyploid forms of barley have been obtained.

Wheat.—Work with wheat continues to be concerned chiefly with spring types. The main object is the production of early-ripening forms resistant to lodging and resistant to loose smut. Spring wheats are being collected from various parts of the world. At Corstorphine the resistance of these wheats to loose smut under Scottish conditions is determined by artificial infection, and those that prove resistant and are otherwise suitable are being used as parents in the breeding work.

Beans.—Field beans and Soya beans have been grown for several years on a small scale. An appreciable amount of natural intercrossing has been taking place among field beans, and this has necessitated precautions being taken to avoid its recurrence. Different selections are grown spatially isolated, but this method limits the number of varieties and the amount of each that can be grown in a season. From a number of crosses of different varieties of field beans the more promising types are being selected. The possibilities of producing an early-maturing heavy-yielding field bean are being kept in view, and an early-ripening type obtained from Russia several years ago is being increased in quantity so that the variety may be tried as soon as possible on a field scale.

Weather conditions at Corstorphine in 1939 appeared to be more favourable than usual for Soya beans, and one of the best crops yet obtained was produced at the Station that year. In the taller-growing varieties the plants were bushy and reached a height of 27 inches, but many of them produced

no seed. Some of the shorter varieties, which grew to a height of about 12 inches, produced a little seed, but not nearly enough to indicate that they were worth trying on a field scale.

Linseed.—Various selections of flax (seed type) have been secured from Canada and the Argentine. Most of these were grown at the Station in 1940 for the first time, and it is intended to make further observations on them in succeeding years.

Transfer of Sub-Station.—Some of the advantages accruing to the plant breeder through his being able to compare and select crop plants under different sets of field conditions were being realised at the Society's upland sub-station at Ainville, Kirknewton, Midlothian, which had been available for experimental work since 1926. Originally the ground at the sub-station was used only for potato breeding, but latterly more ground was obtained, and the scope of the investigations was advantageously widened to include work with herbage plants and oats. The Society's tenure of this ground terminated, however, at November 1939 on the entry of a new tenant to Ainville Farm. Early in 1940 an arrangement was made with the Governors of the Edinburgh and East of Scotland College of Agriculture whereby the Society has rented about six acres of land lying at an elevation of 600 feet above sea level, at Boghall Experimental Farm, for plant breeding experiments. The Society's greenhouses and other buildings at Ainville were dismantled and re-erected at Boghall. This work was completed in April 1940, and the sub-station experimental work was continued without serious interruption.

THE WEST OF SCOTLAND AGRICULTURAL COLLEGE.

(a) ANIMAL HUSBANDRY DEPARTMENT.

The Animal Husbandry Department was set up as a branch of the Advisory Services of the College in August 1939, and replaces the Milk Production Department. The new department provides an advisory service to all live stock farmers in the College area, as well as to those engaged in dairying. While certain lines of investigation developed by the Milk Production Department are being continued, experimental work has been extended to deal with problems of immediate practical importance in all branches of animal husbandry, and especially sheep nutrition.

Nutrition of the Dairy Cow during late Pregnancy.—A number of herds in the West of Scotland experience a heavy mortality each spring amongst the calves. In ten affected herds specially prepared vitamin and mineral mixtures were fed to spring calving cows during the last month of pregnancy. It was found that a supplement of 60,000 I.U. of vitamin A. to the diet of the cows reduced the calf mortality by 50 per cent, while the incidence of scouring attacks was reduced by 60 per cent. The experiment is being repeated with larger doses of vitamin A. fed over a longer interval previous to calving.

Vinquish in Sheep.—A survey has been made in South-West Scotland of the distribution of vinquish, a debilitating disease of sheep referred to by Aiton in 1810 as being prevalent in this area. The disease shows certain affinities to nutritional deficiencies of ruminants occurring in other parts of the world. In curative experiments a daily dose of 40 mg. iron + 10 mg. copper was administered to sixteen animals, of 10 mg. copper to seventeen animals, and of 1 mg. cobalt to twenty-one animals. Cobalt alone was effective, all the animals recovering quickly from the disease. It appears, therefore, that vinquish is a straight cobalt deficiency. There is also a marked correlation between the geological formation and the incidence of the disease, and this aspect of the work is being studied further in collaboration with the Geology Department of the University.

Swayback in Lambs.—This disease occurs in a number of isolated areas in the south-west, and has been controlled by feeding small amounts (about 10 mg. per day) of copper to the pregnant ewes during the last months of gestation. The effect of copper sulphate dressings on the copper content of the herbage and the productivity of affected pastures has been studied, and, in certain circumstances, this would appear to be a suitable method of control.

Heat Grit in Lambs (galar na moine).—From June onwards a severe facial eczema attacks the lamb crop on Ayrshire and Galloway hill sheep-farms, especially those on the granite formations. Blood analyses have shown that excessive amounts of bilirubin are present in the serum, and the animals suffer from a severe jaundice. A survey of the disease shows that it is prevalent on certain farms within a well-defined area, and is probably another nutritional disorder.

Rearing Orphan Piglings.—This work was undertaken to find the best diets for rearing orphan pigs, and to determine if the early weaning of litters is an economic proposition. The growth rates of young animals removed from the dam

(1) at three weeks and (2) at three days have been studied when reared on artificial diets. It has been found that various supplements are necessary with separated milk which has formed the basis of the diets. All animals removed from the dams at three weeks have been successfully reared, but removal at an earlier date has resulted in a heavy mortality, which has not been eliminated by feeding the most complete diet so far used in the experiments.

(b) MILK UTILISATION DEPARTMENT.

Graded Milks.—The advisory farm visits in connection with high bacterial counts in milk from graded farms continue to indicate that improper methods of treatment of the milking machines are the primary cause of these milk-producing difficulties. Experience during the past year has confirmed the findings expressed in our previous report that chlorine preparations for milking-machine sterilisation can only give satisfaction if the equipment is thoroughly cleaned before chlorine treatment.

In one case of persistent coliform infection, which resulted in the threatened loss of a graded licence on a large dairy farm, the trouble was traced to defective chemical sterilisation. The milk producer had adopted the practice of holding the milking machine tubes and teat cups in a chlorinated solution of water. Examination of this solution showed it to be highly contaminated with coliform bacteria and to have a total bacterial count many times greater than that of the original farm water supply. It is of the greatest importance that constant care and vigilance be given to all chlorine preparations to ensure the continued maintenance of the necessary chlorine strength.

Composition of Milk.—A number of cases of genuine milk of very poor chemical composition has come to the notice of the Dairy Research Department of the College. The majority of these have been associated with smaller herds situated at high and exposed altitudes. While a low level of solids-not-fat in milk is frequently the result of severe mastitis infection, the complete absence of any indication of udder trouble in the herds concerned raises the question of whether the general level of nutrition enjoyed by certain dairy herds on high-lying farms may not be a factor.

Butter.—Preliminary work on the butter-making properties of normal and mastitis-infected milk have shown a marked difference in the colour of the resulting butters. The nature of this difference in colour and other factors concerned will be examined in further work to be undertaken.

It is generally recognised that cream for churning should contain from 30-35 per cent of milk-fat. Experiments in churning double-thick cream, to which sterilised water was added, have shown that such watered cream churns quite normally and with a lower loss in fat. The use of double-thick cream commercially would increase the amount of separated milk that would be available from a given volume of milk.

It is of importance to notice that butter made from this watered double-thick cream in our preliminary experiments appeared to possess greater keeping properties than that from the same milk treated by the standard methods of butter-making.

Utilisation of Cheese Whey.—The reduction in the available supplies of buttermilk, following the restriction of butter-making, has resulted in considerable difficulty in commercial and domestic baking industries. A number of requests for alternative dairy products was received, but no supplies of materials of possible value in the making of such an alternative to buttermilk were available for release by the Food Ministry for this purpose.

The attention of the Dairy Research Department of the West of Scotland Agricultural College was directed to this very urgent problem, rendered doubly pressing by the announcement that the use of milk, separated milk, and milk powder was prohibited in baking. The sole dairy by-product which could still be used was whey, but this material was considered of little economic value and entirely different chemically and physically from buttermilk. By means of a new and special process, a new dairy product, similar in many respects to first quality buttermilk, has been produced from cheese whey. The process is simple, requires little in the way of elaborate machinery, and places an enhanced value on every gallon of cheese whey produced in our country creameries. There is a clamant demand by our baking industry for buttermilk supplies. The new product has been stated to be superior to buttermilk. Considerable economic benefit should accrue to the milk producer by widespread manufacture of this new Auchincruive product from the many millions of gallons of cheese whey now available in Britain.

Publication.—A description of a method of cheese-making to suit the needs of the small dairy owner and to permit the adaptation and use of the most simple dairy equipment, already present in many small dairies, appeared in a recent agricultural journal. Reprints of this article are being secured to meet the requests of many inquirers.

THE HANNAH DAIRY RESEARCH INSTITUTE.

KIRKCUDDRY, Ayr.

The Importance of Home-Produced Feeding-Stuffs.—The need for increasing the home production of animal feeding-stuffs has been stressed in previous reports, as well as in a review article which was published in the 'Transactions' of 1938. The war has added greatly to the importance of this general problem. Determined efforts have been made to achieve self-sufficiency on the Institute's own farm during the past two years, with notably successful results. Not only have purchases of feeding-stuffs been reduced to nil, but, by means of the large-scale production of high-quality grass silage, surplus produce has been made available for sale to other farms. It is of interest to note that the problem of disseminating the important results of this work has been tackled by arranging for numerous lantern lectures, as well as by circulating illustrated booklets outlining the general principles involved.

Further work is being carried out to assess the value of various novel substitutes for imported feeding-stuffs. In particular, the value of synthetic nitrogen compounds, such as urea and ammonium bicarbonate, is being studied. The value of artificial drying as a method of conserving young grass herbage is also receiving attention. Side by side with these studies, investigations are being made into the best conditions for the storage of feeding-stuffs, a subject of special importance in view of the increased quantities now liable to be stored in ill-adapted farm buildings.

Bovine Mastitis.—Reference has been made in previous reports to the work undertaken at the Institute on the control and treatment of bovine mastitis. The adverse effect of mastitis on milk yield is well known, and the need for maintaining the country's milk production at the highest practicable level lends special importance to work on this disease.

In earlier work it was possible to undertake control measures in only a very limited number of herds. Last year the number was increased to between fifteen and twenty herds. Subsequent to the outbreak of war, the Agricultural Research Council agreed that the work should be substantially extended, and the Institute is now supervising control measures in some fifty to sixty herds. It has been realised, moreover, that if maximum progress is to be achieved, every available means must be employed to reduce the incidence of infection. In the Institute's scheme of control the adoption of hygienic

measures of control is being combined with the chemotherapeutic treatment of individual animals, the chief agents used being acriflavine and sulphanilimide.

The Bacteriological Control of Milk.—During the war period shortage of skilled labour and other difficulties will almost inevitably lead to a deterioration in the methods of milk production and consequently in the hygienic quality of the milk supply. Routine laboratory control is therefore likely to become progressively more important as a means of checking production methods.

In order to assess the value of the methylene blue reduction test for this purpose a series of experiments has been undertaken in which samples of commercially produced milk have been subjected to widely varying temperatures of storage and in which the plate count and methylene blue reduction test have been directly compared. Parallel studies have also been made of the reliability of the resazurin test, a method which is very similar to the methylene blue test, but which is claimed to give far more rapid results.

The Manufacture of Milk Powder.—The development of the milk powder industry has brought with it numerous technical problems which have required solution. Extensive investigations have been carried out into the hygienic quality of milk powders and into the factors affecting their keeping quality, with particular reference to the development of insolubility and of fat deterioration (tallowiness). In order to enable production experiments to be carried out on a laboratory scale, a small experimental drier has been designed and erected at the Institute. This has been used successfully in drying such diverse materials as milk, egg yolk, blood plasma, and various plant juices.

The Utilisation of Milk By-Products.—Recent developments in the utilisation of whey and other by-products have been in the direction of drying, either by the spray or roller process. The manufacture of the dried product from acid or neutralised whey involves, however, special problems, particularly when the roller process is used. Experiments have therefore been carried out to determine how acidity development can be minimised, and how best the effects of any developed acidity can be counteracted. At the same time certain related problems, such as excessive foam formation, have been investigated. Methods of utilising the dried product have also been studied, particularly in relation to the baking and confectionery trades.

MACAULAY INSTITUTE FOR SOIL RESEARCH.

CRAIGIEBUCKLER, ABERDEEN.

The work of the Institute has been modified considerably to meet war-time conditions, and attention has been concentrated on advisory work. Research problems of immediate practical importance have been continued, but certain branches of the research work have had to be curtailed or discontinued.

Advisory Work.—As indicated in previous reports, the Institute undertakes the testing of soils on behalf of farmers, and any farmer in the North of Scotland can have this done, free of charge, on application to the North of Scotland College of Agriculture or the Macaulay Institute.

On account of the urgent need for increased food production, and the desirability of using the available supplies of fertilisers to the best possible advantage, farmers are urged to take advantage of these facilities. Adequate liming and manuring would bring about a marked increase of crop on many farms. A paper by W. G. Ogg and A. B. Stewart, dealing with liming and manuring, appeared in the 'Scottish Journal of Agriculture,' Volume XXIII., No. 2, p. 145 (January 1941).

During the year approximately 3200 samples have been examined, and special attention has been given to the old grassland which is being ploughed up. From the results obtained with these soil samples a comparison has been made of the lime, phosphate, and potash supplies of old grassland as compared with arable land in the North of Scotland. The general position has been found to be roughly as follows :—

Lime.—Less than 10 per cent of the samples examined have satisfactory lime contents, and over 40 per cent are in need of heavy dressings of lime. These figures vary with the type of soil, the rock from which it is formed and so on, but the low percentage with satisfactory lime contents occurs in both rotation land and old grassland.

Phosphate.—In arable rotation land only about 20 per cent of the soils have satisfactory phosphate contents and about 25 per cent are in need of heavy dressings. The remaining 55 per cent are generally in need of more phosphate than they are getting. In old grassland the position is relatively much worse; about 60 per cent of the soils are either very low or low, about 30 per cent slightly low and only about 10 per cent satisfactory.

Potash.—The position in regard to potash supplies is more satisfactory than it is in respect of lime and phosphate. In rotation land, although only about 25 per cent of the soils have really satisfactory potash contents, the majority of the remainder are only slightly low. Whereas phosphate deficiency is much more pronounced in old grassland than in rotation land, the opposite holds for potash. In old grassland well on to 60 per cent of the soils have satisfactory potash contents, and most of the remainder are only slightly low.

General Soil Fertility Investigations.—A number of experiments with lime, phosphate, and various substances such as city refuse and crushed biotite likely to be of value as manures have been continued. Lime generally had little effect in the season following its application, but in the second season definite yield increases of the order of 20 to 40 per cent followed the application of lime to acid soils. With phosphate, yield increases over the control of anything up to 60 per cent were obtained. In the season following application superphosphate was if anything slightly superior to basic slag; in the second season superphosphate and basic slag both showed mark residual effects, and basic slag was if anything slightly superior to superphosphate. The results generally confirm the observation that, as a source of phosphate, there is little to choose between high soluble basic slag and superphosphate. The effects of the different treatments on the composition of the produce and on the properties of the soil are being studied, and particular attention is being paid to phosphate fixation in the soil—i.e., to that portion of added phosphate which, particularly in acid soils, becomes fixed in an insoluble form of little value to plants.

Soil Surveys and Geological Work.—The survey work has been continued as far as circumstances would permit, and sampling for advisory purposes has been combined with the soil surveying. An area of 100 square miles in Aberdeenshire has now been completed. On forest soils, a paper by A. Muir and G. K. Fraser dealing with the Soils and Vegetation of the Bin and Clashindarroch Forests has been published in the 'Transactions' of the Royal Society of Edinburgh (Vol. LX., Part I., No. 8, pp. 233-333). A study has also been begun of soils in relation to tree growth on areas where war-time felling is taking place.

Peat and Composts.—Tests are continuing on the horticultural value of different kinds of peat for the growth of glass-house crops and along with other materials for producing composts.

Spectrographic Work.—Various papers on this subject have been published during the year, and a paper on cobalt manuring in relation to the pining of stock is being published jointly with the Animal Diseases Research Association.

Limestone Resources of Scotland.—In co-operation with the Geological Survey, the Institute is making a study of Scottish limestone resources. The Geological Survey is carrying out the field work—*i.e.*, collection and description of limestones, while the Institute is making the analyses of the samples. A considerable number have already been analysed, and data for those limestones occurring in the North-East of Scotland have been issued as a war-time pamphlet by the Geological Survey. Work on samples from other areas is in hand. It is hoped eventually to issue a Memoir on the limestone resources in Scotland. Analyses of certain economic minerals—*e.g.*, phosphate deposits, have also been made on behalf of the Geological Survey.

MILK RECORDS.

THIRTY-EIGHTH YEAR—RECORDS OF 40,927 COWS.

By JAMES A. PATERSON, Secretary-Superintendent,
The Scottish Milk Records Association.

SYSTEMATIC milk recording in Scotland was continued in 1940 under the direction of the Scottish Milk Records Association on the same lines as in previous years, notwithstanding the fact that the Exchequer grant to meet administration cost was discontinued as from 31st March 1940. The Association were fortunate, however, in obtaining a grant at the rate of £500 per year from the Ayrshire Cattle Herd Book Society, and £100 per year from the British Friesian Cattle Society; the balance of the total cost to the Association to operate the Scheme being met by the members of the Milk Recording Societies.

The Association in 1940 consisted of the following members of Milk Recording Societies :—

Name and Address.	Body Represented.
Mr E. A. Bell, 2 Miller Road, Ayr . . .	Central and South Ayrshire Milk Recording Society (6 Circuits).
Mr Jas Cochrane, N.D.A., Auchincruive, Ayr	
Mr John Lockhart, Stair House, Tarbolton	
Mr William Wallace, Lyonstone, Maybole . .	
Mr R. H. U. Stevenson, Corseclays, Ballantrae	
Mr M. Semple, Sandhill, Drongan . . .	Central Ayrshire No. 2 Milk Recording Society
Mr George Templeton, Carnell Home Farm, Hurlford	
Mr Thos. Blackwood, Hill of Kilncazow, Carluke	Central Scotland Milk Recording Society (5 Circuits).
Mr M. Bowie, Balmuildy, Maryhill . . .	
Mr Thos. Johnstone, Standalane, Falkirk . .	
Mr J. C. Lohoar, Wellshot, Cambuslang . .	
Mr James McCall, The Broom, Stirling . . .	
Mr W. McEachlan, Crookedstone, Quarter	Dumbartonshire Milk Recording Society.
Mr Robert Watt, Milligs, Helensburgh . .	
Mr James Howie, Muirside, Dumfries . . .	Dumfriesshire Milk Recording Society (3 Circuits).
Mr John Johnstone, Millantae, Lockerbie . .	
Mr J. Stevenson, Muirhill, Dumfries . . .	East Lothian and Border Milk Recording Society.
Dr Chalmers Watson, Fenton Barns, Drem . .	
Mr James W. Clement, East Pitkerrie, Anstruther	Fife Milk Recording Society (2 Circuits).
Mr Thomas Jardine, Balmakin, Colinsburgh	

Name and Address.	Body Represented.
Mr Angus Matheson, Drakies, Inverness .	Highland Milk Recording Society.
Mr Andrew Smith, Drummole, Campbeltown	Kintyre Milk Recording Society.
Mr John T. Kirkwood, B.Sc., N.D.A., Scorrieholm, Lesmahagow	Lesmahagow Milk Recording Society.
Mr John Wallace, Whitechills, Sorbie . .	Machars Milk Recording Society (2 Circuits).
Mr Robert Laird, Lawthorn, Irvine . .	} North Ayrshire (John Speir) Milk Recording Society (3 Circuits).
Mr J. M. Matthew, Girthill, Saltcoats . .	
Mr Thomas Murdoch, West Tannaeriel, Kilmarnock	
Mr J. R. McCaw, Douneside Home Farm, Tarland	North of Scotland Milk Recording Society (3 Circuits).
Mr Robert Howie, Flatterton, Greenock .	} Renfrew and Bute Milk Recording Society (2 Circuits).
Mr John Raeside, Hatrick, Kilmalcolm .	
Mr Andrew McCartney, West Dykebar, Paisley	} Renfrewshire (Upper Ward) Milk Recording Society.
Mr John Forster, Mains of Larg, New Luce	
Mr J. G. Baird, Kirkchrist, Kirkcudbright .	} Stewartry of Kirkcudbright Milk Recording Society (5 Circuits).
Mr George Barbour, Auchengibbert, Crocketford	
Mr John Corrie, Park of Tongland, Castle Douglas	
Mr Walter C. Crawford, Chapmanton, Castle Douglas	
Mr J. M. Gilmour, Chapelton, Bogue .	
Mr A. B. Fowler, Ph.D., B.Sc., Kirkhill, Ayr	
Col. W. T. R. Houldsworth, Kirkbride, Maybole	} The Ayrshire Cattle Herd - Book Society of Great Britain and Ireland.
Mr James Howie, Muirside, Dumfries . .	
Mr A. W. Montgomerie, Westburn, Cambuslang	} The British Friesian Cattle Society.
Mr James Kilpatrick, Craigie Mains, Kilmarnock	
Mr A. McIntyre, Dunallan, Rothesay . .	} The Highland and Agricultural Society of Scotland.
Mr James Kilpatrick, Craigie Mains, Kilmarnock	
Mr William Montgomery, North Milton, Kirkcudbright	} The West of Scotland Agricultural College.
Mr James Wither, Awhirk, Strauraer . .	
Mr James Dunlop, Midland, Prestwick .	} The Edinburgh and East of Scotland College of Agriculture.
Principal W. G. R. Paterson, 6 Blythswood Square, Glasgow	
Mr William Brown, Craigton, Bishopston .	
Mr A. Cunningham, D.Sc., 13 George Square, Edinburgh	
Mr A. M. Smith, D.Sc., 13 George Square, Edinburgh	

Name and Address.	Body Represented.
Mr Arthur R. Wannop, B.Sc., B.Eng., 41½ Union Street, Aberdeen	The North of Scotland College of Agri- culture.
Professor J. Hendrick, Marischal College, Aberdeen	
Mr J. F. Tocher, D.Sc., 41½ Union Street, Aberdeen	Animal Diseases Research Association.
Mr John Foister, Mains of Larg, New Luce .	
Mr W. Cassels Jack, Robiesland, Lanark .	The Hannah Dairy Re- search Institute.
Mr A. B. Fowler, Ph.D., B.Sc., Kirkhill, Ayr	
Mr Norman C. Wright, M.A., Ph.D., Kirkhill, Ayr	Co-opted Members.
Mr Alan Barr, Hobsland, Monkton . . .	
Lord Rowallan, Rowallan, Kilmarnock . .	
Mr John Speir, 81 Hope Street, Glasgow	
Sir Hugh Shaw-Stewart, Bt., K.C.B., Ardgowan, Inverkip	
Lt. Col. W. Guy Shaw Stewart, Ardgowan. Inverkip	

Chairman—Col. W. T. R. Houldsworth.

The following were the principal members of the staff :—

Superintendent Secretary—Mr James A. Paterson.

Assistant Superintendent—Mr Percy H. Hart.

SCHEME OF OFFICIAL MILK RECORDS.

ADMINISTRATION.

In 1940, as in previous years, the scheme of official milk records was administered by the Association through local milk recording societies. During the latter part of 1939 and the earlier months of 1940 every effort was made to obtain new members for local societies throughout the various dairying districts of Scotland, and 49 definite applications were received. But for various reasons, such as members disposing of their dairy herds or removing from their farms, &c., resignations were somewhat greater than usual.

All the local societies which operated in 1939 continued in 1940. The number of recorders' circuits in 1940 was 41, 6 less than in the previous year. The number of herds officially tested was 863 and the number of cows officially tested, 40,927, a decrease of 40 herds and 131 cows from the previous year.

The following is a list of the milk recording societies which operated in 1940, with the name and address of the Secretary of each society :—

Name of the Society.	Secretary.
Central and South Ayrshire (6 Circuits)	Mr E. A. Bell, M.A., B.Sc., 2 Miller Road, Ayr.
Central Ayrshire No. 2 .	Mr James Caldwell, Moorfield, Kilmarnock.
Central Scotland (5 Circuits)	Mr Arthur Gilmour, C.A., 23 Silvergrove Street, Glasgow.
Dumbartonshire . . .	Mr Robert Bilsland, Quay Place, Dumbarton.
Dumfriesshire (3 Circuits)	Messrs Henderson & Mackay, Solicitors, Lockerbie.
East Lothian and Border .	Messrs Inglis, Orr, & Bruce, 19A Hill Street, Edinburgh.
Fife (2 Circuits) . . .	Mr F. Dow, Commercial Bank, Thornton.
Highland	Mr J. M. Hunter, Queensgate, Inverness.
Kintyre	Mr Donald Armour, Machrihanish, Campbeltown.
Lesmahagow	Mr James Hamilton, Auldtoun, Lesmahagow.
Machars (2 Circuits) . .	Mr William Christison, Barglass, Kirkinner.
North Ayrshire (John Speir) (3 Circuits)	Mr George F. F. Smith, Union Bank, Kilmarnock.
North of Scotland (3 Circuits)	Mr Robert C. May, Advocate, 77 Crown Street, Aberdeen.
Renfrew and Bute (2 Circuits)	Mr Thomas Hunter, Solicitor, 35 High Street, Paisley.
Renfrewshire Upper Ward	Mr S. C. Kirkland, Bank of Scotland, Newton Mearns.
Rhins of Galloway (3 Circuits)	Mr W. Brown Moir, 8 Bridge Street, Stranraer.
Stewartry of Kirkcudbright (5 Circuits)	Mr Patrick Gifford, Solicitor, Castle Douglas.

SEASON 1940.

The following table shows for each society or circuit the number of herds, the number of cows tested, the average interval between tests, and the duration of the recording season :—

[TABLE.]

Name of the Society or Circuit.	No. of Herds.	No. of Cows Tested.	Average Interval between Tests, in Days.	Duration of Recording Season, in Weeks.
Central and South Ayrshire—				
1. Ayr and Troon	21	855	26	52
2. Coylton and Ochiltree	21	784	26	52
3. Cumnock	22	813	28	52
4. Girvan	20	989	26	52
5. Kilmarnock	22	922	28	52
6. Maybole	23	1054	28	52
7. Central Ayrshire No. 2	20	869	25	52
Central Scotland—				
8. Carlisle and District	22	891	28	52
9. Dunblane and District	22	871	28	52
10. Falkirk and Linlithgow	21	699	27	52
11. Strathaven and District	22	937	28	52
12. Strathendrick	20	1127	26	52
13. Dumbartonshire	24	961	28	52
Dumfriesshire—				
14. Dumfries—No. 1	22	972	28	52
15. " No. 2	22	1028	28	52
16. " No. 3	22	1004	28	52
17. East Lothian and Border	25	1111	28	52
Fife—				
18. Dunfermline and Kirkcaldy	22	968	28	52
19. Cupar-Fife and Perth	23	1030	28	52
20. Highland	22	787	26	52
21. Kintyre	8	364	28	52
22. Leamabagow	24	928	28	52
23. Machars—No. I.	18	895	25	52
24. " No. II.	19	891	26	52
North Ayrshire (John Speir)—				
25. Fenwick	22	1078	28	52
26. 'John Speir'	23	918	28	52
27. Stewarton and Montgomerie	22	1017	28	52
North of Scotland—				
28. Aberdeen, Kincardine and Angus	20	1009	28	52
29. Aberdeen, Moray and Banff	19	1239	28	52
30. Aberdeenshire	22	1042	28	52
Renfrew and Bute—				
31. Bute	20	566	28	52
32. Paisley and District	21	860	28	52
33. Renfrewshire Upper Ward	13	696	28	52
Rhins of Galloway—				
34. Kirkcolum and District	22	1456	28	52
35. Kirkmaiden and District	20	1766	28	52
36. Luce Valley	24	1536	28	52
Stewartry of Kirkcudbright—				
37. Dalbeattie and New Abbey	23	1183	28	52
38. Castle Douglas & New Galloway	22	1275	28	52
39. Castle Douglas and District	22	1172	28	52
40. Kirkcudbright and District	21	1164	28	52
41. Borge, Twynholm & Gatehouse	20	1200	28	52
Total No.	863	40,927	...	...

DEFINITIONS.

The milk records compiled by the Association are records of the estimated quantity of milk produced by each cow in a separate lactation, and of the estimated percentage of milk fat contained in the milk. For convenience a gallon of milk is reckoned as 10 lb. A gallon of milk of average quality weighs almost exactly $10\frac{1}{2}$ lb. The following further particulars concerning each record were also given wherever possible :—

Name of cow, byre number, and herd-book number.

Sire of cow and herd-book number of sire.

Dam of cow and herd-book number of dam.

Date of birth.

Date of calving preceding opening of record.

Number of weeks in milk.

Date of calving after record closed.

The following particulars of the preceding record were appended to each record, where available :—

Date of calving preceding opening of record.

Quantity of milk in gallons.

Percentage of fat in milk.

Number of weeks in milk.

The milk yields were estimated in respect of quantity and milk-fat percentage from the results of systematic periodic tests by trained recorders approved by the Association. The recorders visited the farms for this purpose at intervals varying from twenty-one to twenty-eight days, and each day of visit was regarded as the middle day of the period covered by the test. Milk records estimated in this way approximate closely to the actual milk yields.

METHOD OF RECORDING—OFFICIAL RECORDS.

A distinctive feature of milk recording in Scotland in 1940, as in previous years, was that the official records were entirely the work of trained official recorders. Recorders had previously to undergo a special course of training in milk recording at the West of Scotland Agricultural College or other approved College of Agriculture. Only candidates of good character and good general education were selected to attend these courses ; and all recorders, before appointment, were approved by the Executive Committee of the Association.

All dairy farmers taking advantage of the Association's scheme were arranged into Local Milk Recording Societies employing one or more recorders, the Executive Committee having power to transfer members from one local society

to another, in order to find accommodation for new applicants, and at the same time avoid overlapping of recorders' circuits. Each local society applying to the Association for licence to conduct milk recording under the Association's scheme signed the form containing the Association's rules and regulations, and agreed to conform to these rules. The local society selected and appointed their recorder or recorders from the list of approved recorders obtained from the Association. Apparatus, chemicals, sheets, and books were selected and arranged for by the Association, all byre sheets and record books used by the recorders being supplied free of charge. Thus uniformity of method was, as far as possible, assured.

The official recorder visited each herd at intervals of not more than twenty-eight days, or more usually from twenty to twenty-six days. He, or she, arrived at the farm in the afternoon, usually by means of a small pony and trap provided by the local society for the purpose, or by motor-car, and was accommodated at the farm overnight. All cows giving milk in each herd, as far as was possible, were included in the records. Each cow was clearly distinguished in the byre by a stall number on the wall, immediately in front of and above the level of the cow, and registered animals were also indelibly tattooed on the ears with distinctive registered tattoo markings. The cows were milked in the same rotation, evening and morning, on the occasion of the recorder's visit. The recorder weighed and sampled the milk of each cow in the evening, noting the time at which each cow was milked, and entered the results in the corresponding columns in the byre sheet, taking up a position in the byre as near to the milkers as possible, so as to have them in full view, and, as far as practicable, receiving the milk direct from the milker at the cow's side. He again weighed and sampled the milk of each cow in a similar manner in the morning, and entered the results in the byre sheets. He then tested the mixed evening and morning proportionate sample for each cow by the Gerber method for percentage of milk fat. He entered in the byre sheet any unusual conditions likely to affect the milk yields. The recorder was required to see that all milk samples and byre sheets were securely locked up overnight or during his absence. From the daily results the recorder calculated and completed the byre sheets, multiplying the yields by the exact number of days which had elapsed since the last test, but so calculating throughout that each day of visit was regarded as the middle day of the period covered by the test. Special ready-reckoners were used to facilitate calculating and to ensure greater accuracy.

The byre sheets were written out in duplicate. The principal copies were posted at regular intervals to the office of the Association, and the second copies left with the respective

members. The recorder transferred the results from the extended byre sheets to the milk record book for the herd indelibly in ink, each cow being assigned a separate page, at the top of which full particulars of the cow were entered, including the indelible tattoo marks on the animal.

The byre sheets were carefully revised and corrected in the Association's office during the season, and a list of the necessary corrections sent to each recorder periodically to be entered in the record books.

Visits of inspection were made to each recorder and to the members of local societies at the different farms periodically throughout the year by members of the Association's staff, and reports thereon submitted to the Executive Committee. The Executive Committee reserved the right to withdraw approval of any recorder at any time, or to limit the period of service of any recorder with any particular society. Members of local societies refusing to observe any of the rules of the Association, or deemed to be guilty of conduct injurious to the true interests of milk recording, were liable to be temporarily or permanently suspended.

Another distinctive feature was the surprise check tests, the records of each herd being checked in this way about two times throughout the year. The recorder was instructed, by a letter from the superintendent on a date unknown to recorder and owner of herd, to remain at the same farm another day and make another complete twenty-four hours' test. The surprise test results were entered on special buff-coloured byre sheets, and in the record books in red ink immediately below the results of the regular test of the previous day. The buff byre sheets were posted to the Association's office with the other sheets, and any abnormal differences were immediately noted and were reported to the Executive Committee.

As a result of this system of surprise check tests, each page of the 1940 milk record books contains entries in red, comparison of which with the immediately preceding entries provides valuable evidence as to the genuineness of the milk records.

In addition to the surprise check tests made by the recorder, a number of independent surprise tests were made by the Association's staff in order to check the recorder's work. A number of surprise re-tests of the milk samples already tested by the recorder were also carried out ; for this purpose recorders were instructed to retain the milk samples each morning till ten o'clock.

All records were closed at the end of December, the current lactations being carried forward to the new books of the following year. Finally, summary sheets were written out in duplicate showing the total milk yield for each cow for the

lactation or part lactation, with full particulars of the cow, dates of calving, &c. The principal copy of the summary sheet was posted to the Association's office with the record book, and the second copy left with the owner of the herd.

All record books and summary sheets were carefully revised, corrected in detail, and initialled in the Association's office during the next few months, the record books being returned later to the respective members, and the summary sheets retained and bound for future reference.

The milk records were next classified into three groups for cows and heifers respectively on the following basis. Experience has confirmed the view that the most useful comparison is obtained by reckoning the yields in terms of pure butter fat. Such a comparison takes into consideration both the quantity and quality of the milk.

Cows with a milk record equivalent to not less than 280 lb. of butter fat, and heifers with a milk record equivalent to not less than 224 lb. of butter fat, were grouped into Class I. Cows and heifers with milk records of less than two-thirds of these amounts—viz., 186 and 149 lb. of butter fat respectively—were grouped into Class III.

The following short table shows the corresponding values of these yields in fairly good milk of 3·5 per cent milk fat :—

Class	Yield of Butter Fat. (Lb)	Corresponding Yield in Milk of 3·5 per cent Fat. (Gallons)
Cows in Class I.	Not less than 280	800
Heifers in Class I.	Not less than 224	640
Cows in Class III.	Less than 186	531
Heifers in Class III.	Less than 149	426

All cows and heifers with milk yields falling between these limits would come into Class II. Such animals naturally claim less attention than the good milkers or the obviously unprofitable animals. It should be noted, however, that Class II. would include a certain number of unclassifiable yields, as there were a number of cases where, from various causes, the results of a whole normal lactation could not be obtained.

It should be noted that while the above standards for classification of milk yields are the same as for 1934 onwards, they are higher than those formerly adopted, in the proportion of 280 lb. of butter fat for a Class I. cow to the former standard of 250 lb., the other standards bearing the same relation as formerly to the cow Class I. standard. This decision of the Executive Committee brought the Class I. standard for cows and heifers respectively into line with those adopted since

1924 for the Association's Annual Register of High-yielding Cows. This subject was dealt with more fully in the 1934 report under "General Review."

It should always be kept in mind when making a comparison of cows in different herds or in different districts that the different methods of dairying practised have a considerable influence on the milk yields, and that therefore milk yields alone do not necessarily indicate the true relative inherent or hereditary milking qualities of the animal. But the authenticated milk records compiled by the Association are of inestimable value to breeders and owners of dairy cows if properly interpreted.

REVIEW—OFFICIAL MILK RECORDS.

Recording was carried on in 1940 by 41 local societies or circuits, comprising 863 members. The number of cows tested in 1940 was 40,927, compared with 41,058 in 1939.

During the course of the year there has been a gradual change over from men to women recorders, as the former left for military service, without any appreciable effect on the efficiency of milk recording.

Twenty-nine women recorders were employed in 1940, and 39 men recorders. The Committee are again indebted to the West of Scotland Agricultural College for giving special courses of instruction for milk recorders to meet the Association's requirements. Three special courses were required in 1940, one in June, one in September, and one in November. Fifty-two selected candidates attended, and 35 obtained the certificate.

The Executive Committee purchased the supplies of milk-testing apparatus, sulphuric acid, and amyl alcohol for local societies, as in previous years.

The system of surprise check tests, introduced in 1920, was continued in 1940. The total number of check tests made by recorders during the season was 508. In no instance in 1940 was the average milk yield for the herd more than 3 lb. milk daily less on the occasion of a check test as compared with the previous day. In addition to the surprise tests arranged for and carried out by the recorders, the Assistant Superintendent made 66 special check tests of different herds. The results in most instances agreed very closely in regard both to average milk yields and fat percentages with those of the recorders' previous tests.

Under all the circumstances, the year 1940 has been fairly satisfactory from a milk recording point of view. Weather conditions were in the main reasonably good, and the average milk yield in the case of recorded herds was on a par with that of previous years. The feeding-stuff position affected yields

to a certain extent in the latter part of the year, but the full effect of this is not apparent in the 1940 records.

UNOFFICIAL MILK RECORDS.

To give effect to the reorganisation necessary through the discontinuance of the Treasury grant in aid of the work of the Association, it was found necessary to discontinue the unofficial scheme of milk recording which was inaugurated in 1924. The Association were very reluctant to take this step, but it was found impossible to carry on the scheme with the staff available, and without making an unduly heavy levy upon the members of same. This scheme, during its last year of operation—namely, 1939, had been the means of obtaining for official milk recording 73 new members of a very desirable type, which was one of the objects for which it was promoted. Taking the scheme as a whole, it served a very useful purpose, but its effect must not be measured merely by the number of herds included in any particular year. Account must also be taken of its educational influence and propaganda value. A considerable proportion of the members who have withdrawn and meantime severed their connection with the Association have acquired the milk recording viewpoint, and will ultimately be found among members of milk recording societies. No fewer than 452 herd owners have been initiated into milk recording through its operation.

PROSPECTS FOR MILK RECORDING.

Very little can be said in regard to the immediate prospects of the Association's scheme of milk recording, but it is hoped to continue the scheme on the same basis under which it was possible to work in 1940. Efforts similar to those of previous years were made to obtain new members for local societies in 1941, and the number of new members obtained for season 1941 to date is 14. A number of resignations have been received. With the exception of one, the local societies of 1940 have continued, but the number of recorders' circuits has been reduced by two. The Rhins of Galloway Society reduced their circuits from five to three. The Renfrewshire (Upper Ward) Milk Recording Society ceased to function as a society owing to resignations, but the remaining members of the society are now being recorded under the Central Scotland Society, who have increased their circuits from five to six. The number of recorders' circuits in 1941 is 39 compared with 41 in the previous year. The total number of herds being officially recorded at the end of April is 795 as compared with 863 in 1940, but the total number of cows tested may show more than a corresponding reduction.

In certain cases the feeding-stuff rationing scheme is being put forward by farmers as a reason for discontinuing milk recording, but it is being pointed out to these farmers that there is now a very real reason why milk recording should be practised, as it is only by the systematic weighing and sampling of milk yields of individual animals that economic and adequate feeding can be arranged.

The position in regard to milk recorders is at the moment fairly satisfactory. The bulk of the men recorders have now been called up for military service, and their places have been taken by women recorders. All vacancies to date have been filled, and there remain a sufficient number of approved recorders on the waiting list.

The Committee have also been able to arrange for the necessary supplies for local societies of sulphuric acid, amyl alcohol, and milk-testing apparatus for 1941, although for all these items a somewhat increased price will require to be paid. The question of the supply of sulphuric acid has been giving the Committee some concern, but the position now seems to be very much easier, and the manufacturers have indicated that they anticipate that no great difficulty will arise in the immediate future.

Systematic milk recording, or herd-testing as it is termed in some countries, has undoubtedly proved of great value to the dairy farmers in Scotland and elsewhere who have regularly practised it. There is no need to elaborate this point at the present day. Effective as it is in peace-time, there is even more need to maintain and extend the practice in time of war, to ensure, as far as possible, that the dairy cows kept produce milk in sufficient quantity and in the most economical manner.

Milk recording enables a dairy farmer to progress by the three main avenues: (1) thorough weeding; (2) economic feeding and more efficient management generally; (3) skilful breeding. The first two of these are of particular importance at all times, but even more so in time of war. Special difficulties to be surmounted will be shortage and high cost of suitable cattle feeding-stuffs and of efficient dairy farm labour. Under these conditions the dairy farmer will still consider he is better off with empty stalls than with cows producing for him a loss. Thus, he will wish, more than ever, to eliminate unprofitable cows from his herd. But skilful breeding for milk production, in the light of the milk records obtained, is no less important as a well-directed effort to increase the proportion of good-milking cows in the cows that are kept. A reduction in the total number of dairy cows in the country is, for various reasons, almost inevitable in years of war, and such reduction will fall to be made good by worth-while cows when peace returns.

ANALYSES FOR MEMBERS DURING 1940.

By Dr J. F. TOCHER, Aberdeen, Analyst to the Society.

DURING the year 1940 the samples submitted to me for analysis included common and compound fertilisers, feeding-stuffs, waters, milks, stomach contents for poisons, feeding-stuffs and shrubs for poisons, and several samples of a miscellaneous character.

FERTILISERS.

Among the compound fertilisers analysed were several for the potato crop. The following table (Table I.) gives the results of analysis of a few of the compound fertilisers analysed :—

TABLE I.

	Nitrogen.	Soluble phosphoric acid.	Insoluble phosphoric acid.	Potash.
Compound potato manure .	4.22	5.60	4.73	9.85
Early potato manure .	8.89	6.42	1.27	7.87
Potato manure .	6.19	5.23	3.26	9.97
Manure .	5.90	..	..	..
No. 1 special mixture	6.58	9.53	3.04	5.42

A sample of waste lime was found to contain 46.4 per cent of moisture and 42.8 per cent of calcium carbonate. This sample was of rather poor quality, since, if perfectly dry, it would have contained only 80 per cent of calcium carbonate. A sample of basic slag was very well ground and contained 14.6 per cent of phosphoric acid. The samples of compound fertilisers, chiefly intended for potatoes, were found to be satisfactory and to contain high proportions of potash. In the case of one of the samples of potato fertiliser, the member wished to know the source of the potash. I found that the potash was derived partly from sulphate and partly from muriate of potash. The proportion of nitrogen in the compound fertilisers varied from 4.2 to 8.9 per cent. The high proportion of 8.9 per cent occurred in a potato fertiliser. The proportion of potash in the compound fertilisers varied from 5 to 10 per cent. According to a provision made by the Fertiliser Controller, the proportion of potash present in a compound fertiliser must not be less than 5 per cent. On the recommendation of the Scottish Fertiliser Distribution Committee, agreed upon by the Fertiliser Controller, compounds manufactured before the 8th August 1940, and containing less than 5 per cent potash, may be offered for sale.

Supplies of muriate of potash and potash salts are still

available in relatively small quantities, and sulphate of potash can also be purchased. The supplies available are reserve stock from France and Germany. For the most part, the supplies available came from France and Germany, but a little potash has been obtained from Palestine. Small quantities have been available from other sources, but the supply of potash, owing to the war, is quite limited.

I have already drawn the attention of members of the Society to the fact that the manurial value of any fertiliser can always be assessed by reference to the guarantee given by the seller. In order, however, to prevent excessive caking of compound fertilisers stored on farms for long periods, it has been found necessary in many cases to add a small proportion of an innocuous material as a drier or conditioner. This procedure has been adopted after consultation between the Ministry of Supply, the Department of Agriculture and the Agricultural Colleges, and it has been all the more necessary because many of the materials of manurial value (such as ground mineral phosphate) which were formerly used as driers are not now readily available for the purpose. The presence of a small proportion of a conditioner in compound fertilisers does not in the least mean a reduction in the fertilising value of the fertilisers, as the sellers must conform to the Act in every way.

The Scottish Fertiliser Distribution Committee have been very active on behalf of farmers regarding the early purchase and suitable storage of fertilisers. Farmers were recommended, in a circular issued, to place their orders several weeks before they required their supplies in order that they might get delivery in time for sowing. This circular had a good effect and induced farmers to make the necessary purchase and storage.

FEEDING-STUFFS.

The feeding-stuffs analysed included samples of meat and bone meal, dairy meal, poultry food, pig meal, linseed cake, earthen cake and meal, hay, bracken and silage. A sample of a distillery by-product was analysed in order to determine its nutritive value. It was stated that the pigs ate the waste with relish. This was found to be due to the presence of a small proportion of an organic constituent which had a pleasant taste. I reported that the material should be continued as an ingredient of the ration, since it had a stimulating effect on pigs fed on the by-product. Several samples of pig meal were sent me for analysis in order to see whether they were of good quality. The proportions of the constituents present were found to be up to the guarantees given. The average proportions of oil, albuminoids, and fibre in the samples of pig meal were: oil 3·5 per cent, albuminoids 12·5

per cent, and fibre 7.3 per cent. It will be seen from Table II. that the oil varied from 1.96 per cent to 4.74 per cent, albuminoids varied from 10.31 per cent to 15.44 per cent, and fibre varied from 5.55 per cent to 12.53 per cent. Complaints were made, regarding other samples of pig food, that the pigs did not relish the food as a ration and in certain cases refused to eat it. The proportions of fibre in these meals were found to be high. I should like to draw attention to the fact that in several instances no guarantees were supplied with the pig meals. In critical times like these it is probable that various untested residues may be tried as feeding-stuffs. It is only by actual feeding experiments that the food may be found to be of practical value. To make cereal pig meals more palatable 10 per cent of an animal feeding-stuff, rich in albuminoids, should be added.

The Order in force with regard to the composition of pig food, including nuts and meal, specifies the ingredients that must be used in the manufacture of National Pig Foods, Nos. 1 and 2. National Pig Food, No. 1, must contain a minimum of 35 per cent maize meal or barley meal or dried potato products, or a mixture of these. A minimum of 20 per cent wheat feed (other than bran) should be present, together with a maximum of 10 per cent each of oats and bran, a minimum of 5 per cent of fish meal, and salt not exceeding 0.5 per cent. Other mineral matter may be added at the maker's discretion. In the case of National Pig Food, No. 2, the proportions of the ingredients are adjusted for fattening purposes. The prescriptions for oil, albuminoids, and fibre content are, for No. 1 Pig Meal, oil (maximum) 4 per cent; albuminoids (minimum) 16 per cent, (maximum) 18 per cent; fibre (maximum) 7 per cent. In the case of No. 2 Pig Meal, the requirements for oil and fibre are the same, while a minimum of 13 per cent and a maximum of 15 per cent of albuminoids are specified.

The proportions of oil in the dairy feeding-stuffs varied from 3.3 per cent to 6.6 per cent, the albuminoids varied from 18.1 per cent to 21.6 per cent, while the proportions of fibre were comparatively low, 7.7 per cent to 8.4 per cent.

A sample of home-grown linseed was found to contain 37.8 per cent of oil, 18.0 per cent of albuminoids, and 24.7 per cent soluble carbohydrates. Calcutta linseed contains about 39 per cent of oil, 18.5 per cent of albuminoids, and 22 per cent of soluble carbohydrates. This sample of home-grown linseed was, therefore, satisfactory both with regard to the proportions of the constituents and otherwise—an encouragement to growers of home linseed. A sample of expeller decorticated earthnut cake contained a high proportion of albuminoids, over 50 per cent, and 9 per cent of oil. Since the cake contained a high proportion of albumin-

oids, it was very suitable to mix with cereals in order to make a suitable ration rich in protein.

I analysed several samples of hay treated by the Proctor Tripod System and compared the results with the results obtained from hay dried in the ordinary way. The value of the Proctor Tripod System cannot be properly gauged, unless a series of properly conditioned experiments is carried out. One-half of a crop of hay should be treated by the Proctor System and the other half should be treated in the ordinary way. A sample of each could then be analysed and the results compared. It has been reported to me that hay made on the Proctor Tripod System retains its green colour longer than hay made in the ordinary way, and that the hay can be more quickly removed from the ground than hay which has been put into an ordinary hay-cock.

The following table (Table II.) shows the composition of the feeding-stuffs analysed :—

TABLE II.

	Oil	Albu- minoids.	Phos. acid.			
Meat and bone meal .	3.22	45.19	11.48			
Meat and bone meal .	7.73	48.19	10.94			
Meat and bone meal .	7.90	49.50	11.65			
			Soluble carbo- hydrates.	Fibre.	Ash.	Moisture.
Distillery by-product .	0.06	6.20	4.52	0.10	0.69	88.43
Dairy compound cake .	6.57	20.28	..	7.69	..	..
Dairy ration . . .	3.28	18.06	..	8.36	..	..
Dairy meal . . .	5.35	21.63	47.70	7.78	7.14	10.40
Dairy mixture . . .	4.90	20.56	..	8.14	..	..
Cake . . .	7.23	16.75	..	9.86	..	..
Feeding nuts . . .	5.55	17.73	46.71	8.05	8.05	13.91
Feeding material . .	0.60	5.59	65.06	9.30	6.15	13.30
Standard grass cubes	4.93	18.55	..	9.70	..	..
Expeller decorticated earth nut cake . . .	9.14	50.75	..	..	..	..
Earthnut meal . . .	10.64	48.81	..	..	..	..
Lamb food . . .	4.60	18.00	..	13.70	..	..
Home-grown linseed .	37.80	18.00	24.67	5.88	3.55	10.10
Linseed screenings .	8.62	16.75	..	8.57	..	..
Growers' mash . . .	..	..	..	6.46	..	..
Barley meal . . .	1.56	10.00	55.21	13.39	6.31	13.53
Bean meal . . .	0.92	21.94	..	8.56	..	..
Pig meal . . .	1.06	11.56	61.79	6.64	5.36	12.69
Pig meal . . .	3.98	12.38	..	7.18	..	..
Pig food (fattening) .	3.48	13.59	..	5.55	..	..
Pig food (sow and wean)	4.18	14.81	..	5.87	..	..
Pig food . . .	2.93	10.31	..	12.53	22.38	..
Pig food . . .	4.74	12.56	..	6.20	..	..
Pig food (No. 2) . .	3.22	15.44	..	7.18	..	..
Pig food (No. 2) . .	3.74	12.13	..	6.62	..	..
Pig food . . .	3.33	10.00	41.69	8.25	28.10	8.63
Poultry food (layers)	4.73	15.47	..	5.98	..	..
Poultry food (growers)	4.33	15.28	..	5.72	..	..
Poultry laying mash	2.76	18.81	..	6.55	..	..
Poultry meal . . .	4.80	16.38	..	4.56	..	..
Poultry food . . .	3.44	17.28	..	6.90	..	..
Baby chick food . .	4.20	16.00	..	6.20	..	..
Hay (timothy) . . .	1.26	4.68	40.74	23.25	3.67	26.40
Hay (ryegrass) . . .	1.45	7.05	37.50	20.27	6.70	21.03
Hay (ryegrass) . . .	1.71	7.25	44.46	29.80	5.61	11.17

From 1903 right up to 1937 the Directors have discussed the problem of the eradication of bracken. No less than twenty-three references to bracken appear in the 'Transactions' of the Society. During the summer months I received, and reported on, several samples of bracken. It was found that the proportion of albuminoids varied not only with regard to the district from which the bracken was sent, but also with regard to the month in which it was collected.

I propose to make a series of analyses of samples of bracken plant taken during the various spring and summer months in order to find the nutritive value in the different months and also to determine the nature of the poison, if any, present in bracken. It is likely that any chemical substance present, injurious to live stock, will be found in the older plants. That is, however, a matter for thorough investigation.

MILKS.

Among the samples of milk analysed during the year, one was below the prescribed presumptive limit of 3 per cent butter-fat, four were below the prescribed presumptive of 8.5 per cent solids-not-fat, while one was below the prescribed presumptive limits in both butter-fat and solids-not-fat. The following table (Table III.) gives the results of analyses of the samples which were sent in for complete analysis. Several samples were sent in for analysis for butter-fat only.

TABLE III.

No.	Fat, per cent.	Solids-not-fat, per cent.	No.	Fat, per cent.	Solids-not-fat, per cent.
1	3.90	8.86	10	3.30	8.81
2	4.06	9.02	11	3.95	8.53
3	4.45	8.94	12	3.48	8.74
4	3.40	7.91	13	3.40	8.45
5	4.38	8.35	14	3.55	8.37
6	3.63	9.14	15	1.28	9.13
7	3.42	8.54	16	2.97	7.76
8	4.45	8.78	17	3.90	8.78
9	4.30	9.00			

There is not much hope at the present time for any revision of the law bearing on the proportions of nutrients in milk. I sincerely hope that after the war is over the authorities will be able to concentrate on the revision of the law bearing on the sale of milk, particularly as great changes have taken place in the milk supply to the public, due to the formation of, and the successful distribution of milk by, Milk Marketing Boards.

WATERS.

As usual, a large number of waters was analysed. Five of the samples were of bad quality and quite unfit for domestic use. One sample was found to contain lead and another copper. Advice was given as to how to eliminate metallic impurities in water. Certain types of water, particularly those of a soft nature, act on copper and lead pipes. A satisfactory way to prevent the presence of copper in water is to use tin-lined copper piping.

POISONS.

Examinations were made for poisons in the stomach contents of live stock. Lead was found to be present in the stomach contents of a cow, while arsenic was found present in the stomach contents of a heifer. Samples of various kinds of feeding-stuffs and shrubs were also sent in for examination for poisons. A sample of expeller decorticated earlnut cake was examined for castor seed, with negative results. Illness of cattle was suspected in a particular case owing to the presence of paint and other possible poisonous material on a plane which had crashed on the field in which the animals were grazing.

When the contents of the alimentary canal of an animal are sent in for examination for the presence of poisons, it is very necessary that the contents of the various organs should be sent *in separate containers*. Certain parts of the organs in a normal condition give an acid reaction, while others give an alkaline reaction. If, therefore, alkalinity is shown in a mixed sample, it cannot be said whether this is due to normal or abnormal conditions unless the proportion of alkali is excessive.

MISCELLANEOUS.

Among the miscellaneous samples analysed were samples of fat being used as part of a ration, encrustations from farm boilers, and material being used as a water softener in connection with a farm water supply. Reports and recommendations were given as to how to use the softening material.

In my report for 1939 I referred to the arsenical poisoning of sheep throughout the country and mentioned that I had brought such sheep poisoning to the notice of the Ministry. I received a reply from the Ministry and the following is an extract from the letter: "Under the Sheep Scab Order of

1938 the dipping bath is required to be prepared by diluting the approved dip with water in the proportion at which the dip is approved by the Ministry, and failure to comply with this requirement where dipping is carried out in conformity with the provisions of the Order would therefore constitute an infringement of these provisions. Where a dipping bath is not prepared in the prescribed manner, whether intentionally or through carelessness or negligence, any losses incurred would be entirely the responsibility of the flock owner. As regards the sampling of dips or of dipping baths under Article 32 of the Order, it rests with the local authority concerned to determine to what extent sampling may be usefully undertaken. Some local authorities are doubtless, according to the circumstances, less active than others in this respect, and your suggestion that local authorities should be urged to give more attention to this matter has been noted."

SCOTTISH RED CROSS AGRICULTURE FUND.

REPORT ON ACTIVITIES DURING THE YEAR 17TH APRIL 1940 TO 16TH APRIL 1941, SUBMITTED TO A MEETING OF THE GENERAL COMMITTEE OF THE FUND, HELD ON 7TH MAY 1941.

THE Committee of the Fund has now completed its first year of operations. The total amount of contributions received by the Fund during the period was £115,811, 9s. 4d. To this was added a sum of £65, 4s. 10d., being interest accruing on certain sums placed on Deposit Receipt for short periods. This gave a grand total of £115,876, 14s. 2d.

The money raised was handed over to the Scottish Branch, British Red Cross Society, and the St Andrew's Ambulance Association, at various times throughout the year. The total allocated to the former body was £92,461, 7s. 4d., and to the latter, £23,415, 6s. 10d.—in all £115,876, 14s. 2d. The allocation was made by the Allocation Committee, and was approximately 80 per cent to the Red Cross and 20 per cent to the St Andrew's.

It will thus be seen that every penny received by the Committee, plus Deposit Receipt interest, was handed over to the benefiting Charities, no deduction whatever being made for expenses. The expenses, which amounted to a sum of £76, 18s. 8d., mainly for postages, printing, stationery, &c., were met by the Highland and Agricultural Society, which also provided the Staff, office accommodation, telephone service, &c., free of charge.

AREA COMMITTEES.

The first steps taken by the Committee were towards the establishment of Local Committees throughout the different areas of Scotland. With this object in view, preliminary meetings were held at centres within each of the Highland Society's Show Divisions. Centres at which such meetings were held were : Edinburgh, 29th May ; Dumfries, 26th June ; Perth, 28th June ; Aberdeen, 5th July ; Stirling, 25th July ; Glasgow, 30th July ; St Boswells, 31st July ; and Inverness, 9th September. At these meetings there were present Directors of the Highland Society within the Show Division, representatives appointed by the National Farmers' Union and Chamber

of Agriculture of Scotland, representatives of all Local Agricultural Societies within the area, Live Stock Auctioneers, and Members of the General Committee resident within the area.

In addition to these Show Division Meetings, a meeting was held at Lanark on 5th August, and at Forfar on 19th August. The reason for holding a Special Meeting at Lanark was that, in that County, there were so many Local Agricultural Societies that it appeared desirable to call a separate meeting for the County. With regard to Angus, as one-half of the County falls within the Perth Show Division, and one-half within the Aberdeen Show Division, it was felt desirable to hold a separate meeting to deal with the County as a whole.

At these preliminary meetings Area Committees were appointed with the object of promoting Free Gift Sales. These Committees were generally formed around Live Stock Mart Centres, and, in each case, a Convener and Secretary were nominated or appointed.

FREE GIFT SALES.

The Centres at which Area Committees were formed and at which Free Gift Sales were subsequently arranged are given in the following list. The dates of the Sales, together with the sums raised at the Sales and by means of collections, and other methods, are also given.

ABERDEEN SHOW DIVISION.

Banff and Cornhill	Oct. 9, 1940	£5020	0	0
	19, 1940			
Huntly	10, 1940	1241	0	0
Ellon—				
(Udny)	12, 1940	1001	0	0
(Ellon)	19, 1940	830	3	11
Keith	12, 1940	839	11	5
Stonehaven	12, 1940	866	4	2
Alford	19, 1940	788	19	2
Aberdeen	26, 1940	2647	6	3
Aboyne	26, 1940	332	14	3
Laurencekirk	26, 1940	2046	0	0
Maud	26, 1940	1506	10	0
Banchory	31, 1940	522	18	0
Dufftown	Nov. 2, 1940	548	5	8
Inverurie	„ 2, 1940	2000	0	0
Turriff	„ 2, 1940	1400	0	0
Insch	„ 21, 1940	1435	8	4
Torphins	Dec. 14, 1940	338	12	1
			£23,364	13 3
Carry forward			£23,364	13 3

Brought forward . . . £23,364 13 3

BORDER SHOW DIVISION.

Duns . . .	Aug. 1, 1940	£3661 18 1	
Newcastleton . . .	Sept. 10, 1940	182 16 2	
Selkirk— (Sunderland Hall) . . .	„ 21, 1940	555 7 0	
Peebles . . .	„ 28, 1940	1355 3 9	
St Boswells . . .	„ 28, 1940	2600 0 0	
Kelso . . .	Oct. 26, 1940	3274 17 9	
Hawick (to a/c of contributions collected)		200 0 0	
		<hr/>	11,830 2 9

DUMFRIES SHOW DIVISION.

Langholm (one - half proceeds) . . .	Sept. 28, 1940	£219 0 0	
Castle-Douglas (do.) . . .	Oct. 17, 1940	4000 5 3	
Thornhill (do.) . . .	Nov. 9, 1940	971 7 5	
Annan (do.) . . .	„ 16, 1940	590 6 2	
Dumfries (contribution from proceeds) . . .	Dec. 14, 1940	650 0 0	
Lockerbie (one - half proceeds) . . .	Feb. 4, 1941	773 15 9	
		<hr/>	7,204 14 7

EDINBURGH SHOW DIVISION.

Linlithgow . . .	Sept. 28, 1940	£1709 8 8	
Edinburgh . . .	Oct. 19, 1940	1692 7 0	
Haddington . . .	„ 25, 1940	3109 5 2	
Dalkeith . . .	„ 26, 1940	2100 10 10	
Bathgate (proceeds not yet received) . . .	Mar. 15, 1941	..	
		<hr/>	8,611 11 8

GLASGOW SHOW DIVISION.

Kilmarnock (North Ayrshire) — (contri- bution from proceeds)	June 29, 1940	£550 0 0	
Wishaw . . .	Sept. 25, 1940	1357 19 0	
Strathaven—(contribu- tion from proceeds)	„ 28, 1940	750 0 0	
Ayr (South Ayrshire) —(contribution from proceeds) . . .	Oct. 5, 1940	4000 0 0	
Biggar . . .	„ 16, 1940	2017 10 0	
Lanark . . .	„ 24, 1940	4009 13 9	
		<hr/>	12,685 2 9

Carry forward . . . £63,696 5 0

Brought forward . . . £63,696 5 0

INVERNESS SHOW DIVISION.

Inverness	Oct. 18, 1940	£590 5 6	
Tain	„ 25, 1940	1211 17 6	
Dingwall	Dec. 7, 1940	3968 14 6	
Dornoch	„ 14, 1940	1110 0 0	
		<hr/>	6,880 17 6

PERTH SHOW DIVISION.

Cupar	Aug. 3, 1940	£2007 7 11	
Milnathort	„ 17, 1940	1270 0 4	
Thornton	„ 17, 1940	2000 0 0	
Blairgowrie	Sept. 14, 1940	2127 10 4	
Aberfeldy	„ 21, 1940	1606 3 7	
Pitlochry	„ 21, 1940	620 0 0	
Anstruther	„ 28, 1940	1465 0 0	
Dunfermline	Oct. 5, 1940	1770 14 8	
Perth	„ 12, 1940	4801 3 8	
		<hr/>	17,668 0 6

STIRLING SHOW DIVISION.

Drymen (Strathendrick Agricultural Society) —(contribution from proceeds)	Aug. 31, 1940	£371 10 0	
Crieff and Auchterarder	Sept. 25, 1940	2031 11 10	
Falkirk	Oct. 26, 1940	2373 11 4	
Stirling	Nov. 9, 1940	5013 0 0	
		<hr/>	9,789 13 2

COUNTY OF ANGUS.

Forfar	Oct. 12, 1940	£3500 0 0	
Brechin	„ 19, 1940	1600 0 0	
Montrose	„ 23, 1940	2319 18 4	
Arbroath	„ 26, 1940	2309 7 0	
Dundee	Nov. 2, 1940	2003 3 0	
		<hr/>	11,732 8 4
			<hr/>
			£109,767 4 6

These Free Gift Sales are classified according to the centres at which they were held. While it might have been of interest to give the results under Counties, this method presented obvious difficulties. The live stock and other free gifts sold at a centre were, in some cases, contributed entirely from within the County, but, in other cases, they were also drawn

from neighbouring Counties, and even from other Show Divisions.

The expectation of the Committee that Free Gift Sales were likely to prove most effective in raising money for the Fund has been amply justified by the foregoing magnificent results. Over 60 Free Gift Sales were held, and the Committees concerned, by means of the sales, collections, and other methods, have contributed a sum of £109,767, 4s. 6d. out of the total of £115,876, 14s. 2d.

Eleven of these Area Committees contributed sums of over £3000, and, of these, two contributed over £5000, and four £4000 or over. One Committee raised over £9000, but its effort was for War Charities in general, and the Agriculture Fund benefited to the extent of £4000. Another Committee raised over £8000, of which the Agriculture Fund received half and the Red Cross Committee of the County the other half. While these larger contributions are mentioned here, it is not to be thought that the Committee of the Fund are oblivious to the fact that in the case of many of the lesser contributions equally fine work was performed by the Committees, although working in smaller or less populous areas.

These remarkable results could not have been attained without the goodwill and cordial co-operation of all the agricultural interests. Thanks are due to the Directors of the Highland and Agricultural Society and to the representatives of the National Farmers' Union and Chamber of Agriculture of Scotland, whose valuable help and co-operation made possible the formation of strong Committees in the various Areas. These Area Committees also included representatives of the many County and District Agricultural Societies throughout the Country. It is impossible to acknowledge adequately the tremendous amount of work done by the Conveners, Secretaries, and Members of these Committees in organising the numerous collections and Free Gift Sales.

Cordial thanks are also due to the Live Stock Auctioneers, without whose help the Free Gift Sales could not have been carried through. The Auctioneers not only gave their services, the services of their staffs, and the use of their Marts free of charge, but, in several cases, also acted as Conveners or Secretaries of the Area Committees. Many, in addition, gave liberal contributions to the Fund. In a number of cases Sale Catalogues were compiled and published, which were not only models of accuracy and detail, but from their artistic production formed fitting souvenirs of the sales.

OTHER CONTRIBUTIONS.

As already indicated, the main efforts of the Committee were directed, in the first instance, towards the establishment

of Area Committees throughout the Country, with a view to organising Free Gift Sales. As the Fund was instituted only on 17th April, this was a matter of some urgency, as otherwise Sales could not be arranged in time for the Sale Season which was regarded to be the months of August, September, and October.

In spite of the fact that no special effort was made in other directions, a sum of £6109, 9s. 8d. was contributed voluntarily by various bodies and individuals. A full record of these contributions appears in the accompanying List.¹ Space permits of reference to only a few of the more outstanding of these contributions.

The National Association of Corn and Agricultural Merchants (Scottish Areas) made the largest individual contribution—£2545. This body also contributed a sum of £28,245 to the Red Cross Agriculture Fund in England—a magnificent performance. Scottish Agricultural Industries Ltd., on behalf of that Company and its Branches and Subsidiary Companies in the Scottish Area, gave the handsome sum of £500. This donation was the more highly appreciated as it was one of the first contributions received by the Committee, and set a gratifying high standard of giving.

Agricultural and Breed Societies were prompt in extending support to the Fund. The list is headed by the Highland and Agricultural Society's grant of £1000. The Aberdeen-Angus Cattle Society and the Ayrshire Cattle Herd-Book Society follow with substantial donations of £100 each, and, as will be seen from the list, other Societies have contributed generously from their funds, in addition to the support given by their members to other efforts on behalf of the Fund.

Young Farmers' Clubs, through the Scottish Association, early evinced sympathetic interest in the Fund, and their support was highly appreciated by the Committee. Mention may be made of contributions amounting to £60, 10s. from the West of Fife Young Farmers' Club, £55 from the Cross-roads and District Young Farmers' Club, Ayrshire, and £50 from the Inverness Junior Agricultural Club. The latter Club has sent a second donation of £50, but this was received too late to be included in the receipts for the year under review. It, however, gives a favourable start to the second year's effort.

Whist Drives and Dances were held throughout the winter by various agricultural organisations, resulting in a welcome addition of £118, 11s. to the Fund.

Horticultural Societies have contributed a sum of £128, 14s. Credit for this must be given mainly to the Garden Show Sub-Committee of the Red Cross Agriculture Fund in England, which has been active in encouraging Horticultural and similar Societies to hold Shows in support of the Red Cross Funds.

¹ A copy of the List accompanied this Report.

In the coming year it is hoped to work in close co-operation with the English Sub-Committee in inviting Horticultural and similar Societies in Scotland to hold Shows of Garden Produce, and a considerable increase in revenue from this source may be confidently expected. The leading contribution during the past year was a sum of £75 received from the Newton Mearns Horticultural Society.

In two Counties where it was found impracticable to organise Free Gift Sales especially on behalf of the Fund, substantial grants were received from organisations already operating in the Counties. From Wigtownshire a grant of £250 was received from the Lord Lieutenant's War Schemes Fund, and from Dumbartonshire a grant of £250 from the County War Benevolent Fund.

The Aberdeen and District Milk Marketing Board generously initiated a scheme of monthly contributions by its milk producers, and a sum of £180, 1s. has been received in respect of the period July to November 1940. The action of the Board in promoting this scheme, and of its producer members in generously agreeing to the monthly impost, are most highly appreciated, and the Committee of the Fund venture to hope that other similar bodies may see their way to follow the splendid example set by the Aberdeen Board.

The Edinburgh and East of Scotland College of Agriculture has instituted a system of quarterly contributions from members of the Staff—a practical method of expressing interest in the objects of the Fund which is worthy of adoption by other similar institutions.

CONTRIBUTIONS BY FARM WORKERS.

In the course of the year the Scottish Farm Servants' Union put forward a proposal for the adoption of a Penny-a-week Collection method whereby farm workers would be enabled to contribute to the Fund. The proposal was considered at a joint Meeting of representatives of the National Farmers' Union and Chamber of Agriculture and of the Scottish Farm Servants' Union, when both bodies agreed to recommend their branches to co-operate in launching the scheme. The thanks of the Committee are due to the Farm Servants' Union for bringing forward this proposal, and to that body and to the National Farmers' Union and Chamber for so kindly agreeing to recommend their branches to co-operate in setting the scheme in motion. A substantial contribution from this source may be looked for in the coming year.

ACKNOWLEDGMENTS.

The success which has attended the Fund during its first year could not have been attained without the valuable

help given by the President, Council, members, and officials of the National Farmers' Union and Chamber of Agriculture of Scotland. The local organisations of that body provided, in many cases, a ready-made basis for the Area Committees, and its Area and Branch Secretaries gave valuable personal assistance, many of them undertaking the duties of Secretary or Treasurer of these Committees. Indeed so keen to help were some areas or branches that, in several cases, they proceeded to organise sales and collections without waiting for any formal appeal from headquarters. Cordial thanks are due to all who gave such devoted service in the interests of the Fund.

It is equally true to say that the success which has attended the first year's activities of the Fund is in great measure due to the loyal help and co-operation of the many County and District Agricultural Societies throughout the Country. On every Area Committee these Societies were represented, and in several cases they provided both the Convener and the Secretary. To their energy and enthusiasm for the cause must be attributed a large measure of the remarkable success of the Fund—a success which has greatly exceeded early expectations.

In conclusion, acknowledgment must be made of much valuable help received from the Committee of the Red Cross Agriculture Fund in England, through the courtesy of its Chairman and Secretary. The two Committees have worked in close co-operation, and the Chairman, Vice-Chairman, and Secretary of the Scottish Committee are members of the Executive Committee of the English body. While the two Committees have their own spheres of activity, their objects are identical and the money which they raise is devoted to the same purposes—providing comforts and medical appliances for the sick and wounded, supplying parcels for Prisoners of War, and caring for those injured or rendered homeless as a result of enemy air-raids, &c. The knowledge and experience gained by the English Committee, in its wider field of operations, has been freely made available for the benefit of the Scottish Committee. For this, grateful thanks are tendered to that Committee, and to its Secretary, Mr Robertson, who has been unfailing in his attention to requests for information, and has offered many helpful suggestions which have been of great service to the Scottish Committee.

JOHN STIRTON,
Hon. Secretary and Treasurer.

ABSTRACT OF RECEIPTS AND PAYMENTS BY THE HON.
SECRETARY AND TREASURER FOR THE YEAR 17TH APRIL 1940
TO 16TH APRIL 1941.

RECEIPTS.

1. Free Gift Sales—Proceeds thereof, including Donations in Cash and other Receipts	£109,767	4	6
2. Agricultural and Allied Bodies—Donations and Contributions	1,605	1	5
3. Agricultural and Commercial Interests—Donations and Contributions	3,366	12	0
4. Grants from County War Funds	500	0	0
5. Young Farmers' Clubs—Donations and other Receipts	213	9	9
6. Whist Drives and Dances—Proceeds of various functions organised by Agricultural Societies, &c.	118	11	0
7. Proceeds of Salvage, &c.	58	6	3
8. Horticultural Societies, &c.—Proceeds of Flower Shows, Donations, &c.	128	14	0
9. Miscellaneous	118	15	3
	<u>£115,876</u>	<u>14</u>	<u>2</u>

PAYMENTS.

Expenses of Administration—

(1) Postages	£25	0	0
(2) Stationery	12	0	9
(3) Printing	6	3	3
(4) Travelling Expenses and other outlays in connection with Meetings	29	12	10
(5) Miscellaneous	4	1	10

Total £76 18 8

Received from the Highland and Agri-
cultural Society of Scotland to defray
Expenses 76 18 8

2. Payments to participating Charities, as determined
by the Allocation Committee of the Fund—

(1) Scottish Branch, British Red Cross Society	£92,461	7	4
(2) St Andrew's Ambulance Association	23,415	6	10
	<u>115,876</u>	<u>14</u>	<u>2</u>

£115,876 14 2

EDINBURGH, 28th April 1941.—I have examined the Books and Accounts of the Treasurer of the SCOTTISH RED CROSS AGRICULTURE FUND COMMITTEE, of which the above is an Abstract, and have found the same to be correctly stated, and sufficiently vouched and instructed.

GEO. JAMES GREGOR, C.A., Hon. Auditor.

THE CEREAL AND OTHER CROPS OF SCOTLAND FOR 1940.

THE following comparison of the cereal and other crops of 1940 with those of the previous year has been prepared by the Secretary of the Society from answers to queries sent to leading agriculturists in different parts of the country.

The queries issued by the Secretary were in the following terms :—

1. What was the quantity, per imperial acre, and quality of grain and straw as compared with last year, of the following crops ? The quantity of each crop to be stated in bushels or cwts. What quantity of seed is generally sown per acre ?—(1) Wheat, (2) Barley, (3) Oats.
2. Did the harvest begin at the usual time, or did it begin before or after the usual time ? and if so, how long ?
3. What was the quantity, per imperial acre, and quality of the hay crop, as compared with last year, both as regards ryegrass and clover respectively ? The quantity to be stated in tons and cwts.
4. Was the meadow hay crop more or less productive than last year ?
5. What was the yield of the potato crop, per imperial acre, as compared with last year ? The quantity to be stated in tons and cwts. Was there any disease ? and if so, to what extent, and when did it commence ? Were any new varieties planted, and with what result ?
6. What was the weight of the turnip crop, per imperial acre, and the quality, as compared with last year ? The weight of the turnip crop to be stated in tons and cwts. How did the crop braird ? Was more than one sowing required ? and why ?
7. Were the crops injured by insects ? State the kinds of insects. Was the damage greater or less than usual ?
8. Were the crops injured by weeds ? State the kinds of weeds. Was the damage greater or less than usual ?
9. Were the pastures during the season of average growth and quality with last year ?
10. How did stock thrive on them ?
11. Have cattle and sheep been free from disease ?
12. What was the quality of the clip of wool, and was it over or under the average ?

From the answers received, the following notes and statistics have been compiled :—

EDINBURGH DISTRICT.

MID-LOTHIAN. *Wheat*—54 bushels per acre. *Barley*—52 bushels per acre ; all very well secured. *Oats*—60 bushels per acre. *Harvest*—Began about the usual time, and under ideal weather conditions, both in early districts and the later ones. *Hay*—A heavier crop ; 45 cwt. per acre, and all well secured. *Meadow Hay*—Much the same as in 1939. *Potatoes*—A heavier crop than usual ; 6 tons per acre on the good lands. *Turnips*—A very good crop, the best for several years ; 20 to 25 tons per acre. *Insects*—Less damage than usual. *Weeds*—Caused less injury than usual, and weather perfect for working of land producing green crops. *Pastures*—Good in early part of season ; suffered from drought in June, but were specially good afterwards. *Live Stock*—Did very well and were free from disease. *Clip of Wool*—Average and of good quality.

EAST LOTHIAN (Upper). *Wheat*—Yield of grain similar to that of last year ; 44 to 52 bushels per acre ; both grain and straw harvested in good condition, owing to having had the best harvesting weather for very many years ; seed sown, $3\frac{1}{2}$ to 4 bushels per acre. *Barley*—Yield of grain rather less than that of last year ; 40 to 52 bushels per acre ; straw rather heavier ; harvested in good condition ; seed sown, 3 to $3\frac{1}{2}$ bushels per acre. *Oats*—Yield of grain and straw somewhat similar to that of last year ; 54 to 66 bushels per acre ; harvested in the best of condition ; seed sown, 4 to $5\frac{1}{2}$ bushels per acre. *Harvest*—Started about same time as last year ; one of the best harvests on record, many acres of wheat being carted without stooking ; work finished in record time. *Hay*—Rather above average crop and secured in the best of condition ; 45 to 55 cwt. per acre ; ricks in fields got rather darkened on the outside owing to wet and fog in July before stacking, but no material damage done to the hay. *Meadow Hay*—Very little grown. *Potatoes*—Slightly under average crop ; 7 to $8\frac{1}{2}$ tons per acre ; lifted and stored in good condition ; a long-drawn-out harvest owing to shortage of gatherers, but luckily there was no frost ; less blight than for many years—practically none ; leaf curl rather worse than previous years, but less trouble from other virus diseases ; very little sprain ; no new varieties grown. *Turnips*—One of the best crops for many years ; 18 to 24 tons per acre, with much less finger-and-toe and dry-rot ; very few cases of second sowing. Still more mangolds being sown, but crop rather lighter than usual. *Insects*—Considerably less damage caused, especially in turnip and potato crops. *Weeds*—Owing to wet weather at hoeing-time weeds (annual) rather more troublesome among turnips and potatoes ; fewer thistles. *Pastures*—Came away early in spring and grazed well all season ; growth about average. *Live Stock*—Both cattle and sheep grazed well and were free from disease. *Clip of Wool*—Rather under average owing to hard winter.

BORDER DISTRICT.

BERWICKSHIRE (Merse). *Wheat*—The autumn of 1939 was not often favourable for wheat sowing, although an increased acreage (statistics not available) was got in somehow; a severe and prolonged spell of wintry weather delayed growth and thinned brairds to the extent that a few fields had to be ploughed up. An early spring helped materially to restore conditions, also allowing for a considerable acreage of spring varieties to be sown, and when ears appeared in the last week of June a doubtful start had been made good. Harvest was general by the end of August; with fine weather the crop was rapidly handled and stacked in exceptionally good order. Grain was hard and dry and fit to thresh at once, with yields to 48 bushels per acre quite common; control price 65s. 3d. per 4½ cwt.; natural weight, 62 lb. per bushel; straw good, of medium length, 28 cwt. per acre; usual seeding, 3½ to 4 bushels per acre. *Barley*—Sown in good time with a good seed-bed, except on the stronger lands which had become hard and dry; seed sown, 2½ to 3 bushels per acre; brairds were irregular and later suffered from the hot, dry conditions; ears appearing first week in July, when the crop was somewhat stunted, and in many cases on bare knowes were affected beyond recovery by drought; rains in July improved matters; cutting commenced by the end of August, the work generally being readily done with ideal conditions for stacking. Yields of 50 bushels per acre were not anticipated in view of appearances, but many fields exceeded that return, with fine quality grain. Straw good, but light at 22 cwt. per acre; natural weight of grain, 56 lb. per bushel. Price, uncontrolled, varied from 85s. to 95s. per 4 cwt. *Oats*—Were sown early, and came away nicely; drought had less effect; the July rains produced second growth, resulting in many samples with green pickles; ears appeared by 20th June, and harvest commenced in mid-August, when the crop was either very light or very badly laid; with the latter cutting was possible one way, leaving a reasonable stubble; thereafter handling was reduced to a minimum. Yields were good at 56 bushels per acre, with many much more; natural weight, 43 lb. per bushel; straw, very fine fodder, produced about 26 cwt. per acre; grain price controlled at 43s. 6d. per 3 cwt. *Harvest*—As already indicated, harvesting conditions were exceptionally fine, commencing rather earlier than usual; with oats ripening ten days before other crops, the work was spread over rather a longer period; there was little interruption and an excellent crop was secured in splendid condition, despite a definite shortage of labour. *Hay*—The dry spring affected this crop, which was below average; the earlier fields were ricked in fine condition, but some damage was caused in July in cases where fields had been stocked with ewes and lambs. There was a fine show of red clovers, and the crop proved valuable fodder; yield, 24 cwt. per acre; few second cuts were taken, and these proved difficult to handle. *Meadow Hay*—A light crop, and some damage and loss caused through delay in cutting on account of weather; yield, little over 20 cwt. per acre, proving far short of subsequent requirements. *Potatoes*—Generally prospects were good all season, though some fields suffered from the earlier dry conditions; in many cases the crop followed old lea, when yields were considerably above average, up to 10 tons per acre with a general run of 7 tons.

There was no disease and the crop kept well with as yet little waste ; the known, reliable varieties were usually planted, and little spraying done. *Turnips*—Light land farms had little difficulty in getting brairds to come away, but strong lands became dried out, necessitating frequent sowings, and resulting in a patchy crop ; generally, however, the ultimate crop, swedes particularly, proved a bumper ; plants did not do very much until October, when real growing conditions set in, and fortunately during the spell of severe frost the part of the crop still in the ground was protected by snow ; a return per acre up to 40 tons was not uncommon, but the average would be little more than usual on account of numerous failures. *Mangolds* lifted a fine crop, were pitted in excellent order, and kept better than usual. *Kale* was disappointing, and any left until January was destroyed by frost and pigeons. *Insects*—Some cases of damage by wireworm on cereals after old lea. *Weeds*—No damage to an unusual extent, except by charlock in grain fields ; weather conditions kept weeds in check amongst roots. *Pastures*—Remained bare all season ; until July it was difficult to keep stock provided with sufficient feeding ; seeds were especially bare as the drought got in and land became badly cracked. *Live Stock*—Pastures too bare for cattle most of the summer ; ewes and lambs did better, but it was not a good grazing season, and there was little if any roughage for autumn ; foggages were also disappointing, but seeds were useful. Stock experienced nothing out of the usual in the matter of disease, though losses at lambing-time were heavy, as a result of the long spell of winter, ewes being leaner than desirable. *Clp of Wool*—Average quality, almost all reaching the maximum control price.

BERWICKSHIRE (Lammermoor). *Wheat*—Due to the ploughing campaign more was grown in this district than for very many years ; the quality of the grain for this high-lying district was quite remarkable and the quantity about an average—say, 36 bushels per acre ; seed sown, 3 to 3½ bushels per acre. *Barley*—More barley was also grown in the district ; the quality was very good and the quantity about an average ; about 40 bushels per acre ; seed sown, 3 to 3½ bushels per acre. *Oats*—Accounted for the main increase in cultivation in the district ; the resulting crop was wonderfully satisfactory, good yields and good quality being secured in some most unlikely situations ; average yield about 48 bushels per acre ; seed sown, 4 to 5 bushels per acre, depending on the variety sown. *Harvest*—About a week earlier than average ; began in third week of August ; weather was outstandingly good ; fields cleared and crop secured in first-rate order in very short time. *Hay*—Rather a light crop ; say, 1½ tons per acre ; early cut hay secured in first-rate order. Fields that had been grazed in early spring and cut later in the season were difficult to handle due to rain in late July, and quality not so good. *Meadow Hay*—An average crop mostly secured in fair order. *Potatoes*—A good crop and well secured ; yield, 7 to 8 tons per acre ; disease not much in evidence ; no new varieties of any note planted. *Turnips*—On the whole a very good crop of good quality ; a few fields patchy where braird failed due to hot, dry weather ; yield, about 20 tons per acre. *Insects*—Less troublesome than in some former years ; the growing weather experienced at the critical time for insect attack kept any serious damage from showing itself.

Weeds—Notwithstanding the shortage of labour and increased cultivation on most farms, weeds were satisfactorily kept in check. *Pastures*—Were of full average growth, and in most cases met the demands of the usual stocks of cattle and sheep carried, even though the acreage had been somewhat reduced by the ploughing campaign; quality no better than usual. Lambs at August sales seemed to lack the bloom of some previous seasons. *Live Stock*—On the average thrived fairly well; lambs on some farms rather seriously affected by worms. This should be improved by the ploughing up of old pastures under war conditions. *Clip of Wool*—Average.

ROXBURGHSHIRE. *Wheat*—A considerable number of crops were very thin in the ground, and consequently the yields varied greatly; where the crop was reasonably well planted the return of grain was at least 8 bushels per acre more than the previous year; the quality of both grain and straw was superior; seed sown, $3\frac{1}{2}$ to 4 bushels per acre. *Barley*—On reasonably good barley land yields were from 44 to 50 bushels per acre; owing to the dry spell early in the growing season a number of fields were badly drouthed; in these cases the bulk of straw, though of good quality, was much under average for quantity. *Oats*—In quite a number of cases the yield was from 70 to 80 bushels per acre; on the whole this crop was above average, both grain and straw being of excellent quality. Where old lea fields were under this crop and properly and timeously seeded, big yields of both grain and straw have been recorded. *Harvest*—Began a little earlier than usual; weather conditions were first-class and the whole crop was secured in ideal conditions in less than the usual time. *Hay*—The hay season was variable; after an early spell in which a considerable acreage of ryegrass hay was got in the best of order, there was a period of wet weather which spoiled a considerable quantity; later on, just before harvest, an improvement in the weather allowed the later men to get their hay well; on the whole the crop was under average in quantity. *Meadow Hay*—Mostly well got, and crop about an average. *Potatoes*—Yield about an average, with not very much appearance of disease. *Turnips*—On the whole the crop braided quite well, although there were a number of cases of resowing; after doing very little for a long time the crop made an exceptionally big growth in October and early November, and in many cases was above average. *Insects*—No serious injury; on the average the damage was very small. *Weeds*—Labour shortage was responsible for the appearance of more annual weeds than are generally seen, especially in the green crops. *Pastures*—Early in the season and well on these were bare and backward, and although they recovered somewhat there never was much reserve for back-end keep. *Live Stock*—Did well generally, although animals were not so well forward at the end of the grazing season as they usually are. The health of the stock showed no change, the usual troubles being more generally understood and kept in check. *Clip of Wool*—Quality was quite good, but quantity much under the average.

SELKIRKSHIRE. *Wheat*—None grown. *Barley*—Very little grown. *Oats*—Yield, from 35 to 46 bushels per acre; the sowing of an extended acreage was completed about the end of April, largely due to the increased use of tractors and tractor implements. Oats got an excellent

seed-bed, and braided well; by the end of June the drought was telling on light, high land, but the heavy rains in July saved the crop, which finished about average; seed sown, 5 to 6 bushels per acre. There was very little laid grain, but it ripened unevenly and a lot was cut on the green side, when the weather was good, resulting in excellent fodder, but just a moderate sample of grain. *Harvest*—Commenced about the usual time, and with excellent weather was quickly handled and secured in record time. *Hay*—Benefited from the rains in July, but was difficult to secure owing to broken weather, and most farmers had less good hay than usual. *Meadow Hay*—A fair crop and, in the later districts, secured in excellent condition. *Potatoes*—Were a very good crop; 7 to 8 tons per acre, free from disease and mostly lifted in dry condition, except where there was a scarcity of potato gatherers. *Turnips*—1940 will be remembered as a 'turnip year'; yield, 20 to 30 tons per acre; they braided well, but were singled with great difficulty on account of scarcity of suitable labour; the crop finished the best for a long number of years. *Insects*—No injury reported. *Weeds*—Less injury than usual. *Pastures*—Less grass than usual on account of May and June being too dry. *Live Stock*—Did fairly well, but never had an abundance of grass. Cattle and sheep kept free from disease. *Clip of Wool*—Excellent quality, but of light weight.

PEEBLESSHIRE. *Wheat*—A larger acreage grown than usual; a good crop which ripened well. *Barley*—Not extensively grown, but more than usual; some fields were badly lodged; yield, from 38 to 48 bushels per acre. *Oats*—Were extensively grown this year, and taken all over they were a very good crop, although it ripened somewhat unequally; good land gave an average yield of from 56 to 64 bushels per acre; the poorer land from 28 to 44 bushels per acre. *Harvest*—Probably began a day or two earlier than usual, and was one of the best harvests in living memory; the straw was excellent. *Hay*—Ryegrass hay, on account of the drought, was somewhat lighter than usual; timothy was a good crop; ryegrass, from 25 to 35 cwt. per acre; timothy, from 40 to 50 cwt. per acre. *Meadow Hay*—An average crop. *Potatoes*—About 7 tons dressed ware per acre; quality excellent and very free from disease. *Turnips*—Suffered in the early season on account of the drought, but grew to be one of the heaviest crops in recent years. *Insects*—No serious damage, but wood-pigeons have caused considerable damage to young clover seeds and growing turnips. *Weeds*—Thistles have been very plentiful in many cases. *Pastures*—Notwithstanding the extra ploughing campaign, many of the holdings still tried to carry the same stock, and what with the reduced acreage and the early drought, pastures were much barer than usual. *Live Stock*—Both cattle and sheep have been free from disease, and evidently summered fairly well. *Clip of Wool*—Much below the average; this especially applies to hill stock, which produced about a 75 per cent clip.

DUMFRIES DISTRICT.

DUMFRIES (Annandale). *Wheat*—A much larger acreage grown; the crop was well harvested, and showed a good sample; yield, about 30 cwt. per acre; straw, 30 cwt. per acre. *Barley*—A small

acreage grown, but owing to dry weather in June it was a very light crop; 30 bushels per acre; straw, 20 cwt. per acre. *Oats*—A larger acreage grown, but owing to dry weather in June the crop was below average; it was well harvested and threshed out fairly well; yield, about 48 bushels per acre; straw, 20 cwt. per acre. *Harvest*—Started about second week in August, and was one of the best experienced for many years; grain stood up well and was much more easily reaped, being mostly cut by tractor and binder. *Hay*—Ryegrass was an average crop on heavy land, but on light land was much under average; all was well got and of very good quality; yield, 35 cwt. per acre. *Meadow Hay*—Was about the same as last year, but part of the crop was spoiled by wet weather in the first two weeks in July; yield, 30 cwt. per acre. *Potatoes*—Were an extra good crop and well harvested; yield, 10 tons per acre; very free from disease; the usual varieties planted. *Turnips*—10 tons per acre; the best crop for many years, of good sound quality, and kept well; they did not braird too well, but improved greatly after the rain in July. *Insects*—No damage recorded. *Weeds*—No injury of any consequence. *Pastures*—Rather bare at the beginning of season, but improved after the rain in July, and on the whole were better than last year. *Live Stock*—Sheep did not do so well as in the previous year, but cattle seemed to do better, especially towards the end of the season; both kept free from disease. *Clip of Wool*—About average.

DUMFRIES (Nithsdale). *Wheat*—None grown. *Barley*—None grown. *Oats*—A very poor crop on most farms; none laid. *Harvest*—Began about usual time or a little later; a lot of second growth amongst oats. *Hay*—A fair crop, heavier than last year, and well got. *Meadow Hay*—About the same as last year and well got. *Potatoes*—The best crop we have had for years, about 7 tons per acre; no disease. *Turnips*—Like potatoes, the best crop we have had for years, about 20 to 26 tons per acre; braired well; no resowing. *Insects*—Crops free from insect pests, but pigeons still a great scourge. *Weeds*—Crops free. *Pastures*—Hardly as good as last year. *Live Stock*—Throve well, but not so well as last year, and cattle and sheep were free from disease. *Clip of Wool*—Average quality.

DUMFRIES (Eskdale). *Wheat*—None grown. *Barley*—None grown. *Oats*—Crops all over were very good, there was very little laid, and all were got in excellent condition; oats threshed well, about 38 to 40 bushels per acre; straw also of very good quality; seed sown, potato oats, 5 bushels per acre, and the heavier varieties, 6 bushels per acre. *Harvest*—Began about the usual time. *Hay*—Ryegrass was a lighter crop than last year, owing to the dry weather, but was mostly got in very good condition. *Meadow Hay*—Was a good average crop, except in some dry fields which were rather short owing to the dry weather; mostly all got in very good condition. *Potatoes*—Very good yield all over with very little disease; a heavier crop than last year. *Turnips*—An excellent crop with heavier yield than there has been for many years; braired and came on well; not much second sowing required. *Insects*—No injury caused. *Weeds*—Less damage than usual. *Pastures*—Got very bare owing to the dry

weather, but came on well later; the quality appeared to be good. *Live Stock*—Did very well. There has been very little disease amongst either cattle or sheep, except that there were a good many deaths from Braxy in some places amongst hogs in the autumn. *Clip of Wool*—The quality was under the average, and it did not weigh as well as last year.

KIRKCUDBRIGHTSHIRE. *Wheat*—Acreage not large, but rather more than in 1939; where land was heavy, crop was good and yield of grain excellent. *Barley*—Practically none grown. *Oats*—On light land, owing to the exceptionally dry summer, the yield of both straw and grain was poor; in some cases late-sown oats were a complete failure; on heavier land, however, the crop was excellent, with a very good yield of grain; in fact, yields of 80 bushels per acre were got off some old pastures that had been ploughed up. *Harvest*—Was very early; a few started in July, and by first week in August cutting was general throughout the county; weather was excellent and crop was stacked in excellent order. *Hay*—Ryegrass that had a good start in May was a fair crop, but owing to dry conditions in May and June the crop average, although better than in 1939, was not large; probably about 25 to 30 cwt. per acre. *Meadow Hay*—Rather better than in 1939, but much below the average; about 25 cwt. per acre. *Potatoes*—Excellent, although barely as good as in 1939; secured in excellent condition; 7 to 8 tons per acre. *Turnips*—The season was ideal for the turnip crop; all over the county it was the heaviest in living memory; yields of 40 tons per acre and over were quite common; average, 28 tons per acre. *Insects*—Very little trouble experienced. *Weeds*—Owing to the dry summer very little trouble occurred. *Pastures*—Although pastures in 1939 were bare during June and first half of July, in 1940 they were far worse; in fact, until the month of October some pastures never really recovered; the average growth for the year was considerably below normal. *Live Stock*—Throve wonderfully well on the short pastures, but the yields of milk were badly down, and fat cattle were about one month later in being ready for market; sheep did well when they were running reasonably light. Some nasty cases of bracken poisoning were experienced, otherwise no great trouble was apparent. *Clip of Wool*—Just a little under the average.

WIGTOWNSHIRE. *Wheat*—Very little grown. *Barley*—Very little grown. *Oats*—Lea oats, 36 to 38 bushels per acre; after green crop, 42 to 44 bushels per acre; seed sown, potato oats 5 to 6 bushels per acre broadcast, 3 to 4 bushels per acre drilled; large varieties, 5 to 7 bushels per acre; the seed-bed was fairly good and oats generally braided well, but a dry June checked progress, and even when rain came there was some aftershot on light land, and straw all over was short; grain filled out well before harvest and a good yield was assured. *Harvest*—Started much about the same time as in the previous year; as the crop on most farms was a standing one, the binder was in general use all over, and good progress was made with the cutting; the weather continued favourable, and on the early farms the crop was secured in good order; a spell of broken weather for ten days checked the work on the later land, but after that favourable conditions were experienced and crops were carried

in good order. *Hay*—Owing to dry weather in part of May and June the hay crop was inclined to be light, probably about 2 tons per acre; where cut early the quality was excellent; the aftermath in many cases was only fair. *Meadow Hay*—About the same as in previous year. *Potatoes*—In the early crop growth was retarded by frost, but potatoes came on well later; owing to scarcity of labour digging on some places took much longer, and many were later in lifting the crop; the yield over all much heavier than in former years, 8 to 9 tons per acre; Epicures chiefly were planted; late potatoes did well and were quite a good crop, 10 to 12 tons per acre. *Turnips*—18 to 20 tons per acre; the braird on most farms was good and the plants came on well; with good weather thinning went on apace and weeds were kept under; when rain came they appeared again, but not so badly as last year. The crop generally was a very good one and fairly free from disease. *Insects*—Marrow-stem kale was attacked by fly on many farms and had to be resown, sometimes twice, in spite of which the crop generally was excellent. *Weeds*—Dockens showed no signs of decreasing, and redshank was prevalent in turnip fields; weeds in pastures were kept under control fairly well considering the shortage of labour. *Pastures*—Gave early promise of being at least average, but this was never fulfilled, and it is some years since fields were so bare in autumn; a very sharp contrast to the previous year, when grass in autumn was abundant. *Live Stock*—The season generally was a poor one for dairy cows; yields were below the average in most cases and the yield in the back-end dropped at an alarming rate; young stock thrived fairly well. Grass sickness, navel ill, and hoven were experienced as usual, but were not on the increase. The blizzard on 27th and 28th January took a heavy toll of outwintered young stock and sheep; a little later the mortality among calving cows in various herds was the highest the writer ever remembers; sheep were healthier than in the previous year. *Clip of Wool*—Above the average in quantity and quality.

GLASGOW DISTRICT.

AYRSHIRE. *Wheat*—Grain, 42 bushels per acre; straw, 18 cwt. per acre; grain was not of such good quality as last year and was not so well filled; straw was more plentiful and was about an average crop; seed sown, 3 bushels per acre. *Barley*—Very little grown. *Oats*—48 bushels per acre of grain; straw, 16 cwt. per acre; the crop generally was about average except on light land, where it suffered from drought; the grain was plentiful, but much of it was light; straw was of good quality; seed sown, 5 to 6 bushels per acre. *Harvest*—Began about a week earlier than usual and was carried on spasmodically at first, but good weather allowed it to be speedily completed. *Hay*—Averaged about 30 cwt. per acre, and was nearly all secured in good condition; clover was very plentiful in all hay crops. *Meadow Hay*—Was a better crop than in 1939 and gave about an average yield. *Potatoes*—The very earliest crops on sandy land were small owing to drought and produced not more than 4 tons per acre, but yields improved as the season advanced and lifting proceeded to more earthy land, and late potatoes were

an average crop of good quality ; disease was not at all prevalent. *Turnips*—The crop was the best that has been seen for a long time, being about 22 tons per acre and nearly all roots sound ; the crop braided normally, but made slow progress after singling owing to dry weather, though it grew well on into the autumn. *Insects*—Where cabbages were grown, grub at the roots was very bad ; otherwise insect pests were not serious. *Weeds*—Were kept under control and crops were not damaged. *Pastures*—Were very good in the early part of the season, but dry weather in June stopped their growth for a month ; they recovered in the autumn. *Live Stock*—Generally did well, though in some cases pastures had more stock than they could carry during the drought ; disease among stock was kept under control. *Clip of Wool*—The clip was under average, but quality was about normal.

BUTE. *Wheat*—None grown. *Barley*—None grown. *Oats*—Good crop ; threshed well. *Harvest*—A little earlier than usual. *Hay*—A good crop ; about 2½ tons per acre. *Meadow Hay*—Practically none grown. *Potatoes*—Fully better crop ; about 9½ tons per acre ; started digging Epicures on 13th June ; good crop ; no new varieties planted as far as is known ; no disease. *Turnips*—Crop good ; but considerable quantity spoiled by frost. *Insects*—No loss reported. *Weeds*—Were easily destroyed ; no damage done. *Pastures*—Of average growth and quality. *Live Stock*—Did very well, and cattle and sheep were free from disease. *Clip of Wool*—Bulk and quality up to standard.

ARRAN. *Wheat*—None grown. *Barley*—None grown. *Oats*—Yield very variable, up to 35 bushels per acre ; the best crop for many years, but on old leys ploughed under the subsidy scheme there were many failures due to the very dry weather in early summer. *Harvest*—Was very early and the crop secured in excellent condition. *Hay*—Crop secured in excellent condition, and the yield in many cases up to 3 tons per acre ; seed perennial ryegrass was grown on many farms, and a very good sample of the seed obtained. *Meadow Hay*—Not much grown and generally of poor quality. *Potatoes*—A good crop, of which the average was about 8 tons per acre ; Arran Pilot continued to be in great demand. *Turnips*—Very variable, and black heart continued to be troublesome ; many farmers have stopped growing them in favour of silage. *Insects*—No damage reported. *Weeds*—Were not troublesome, as the dry summer was suitable for keeping them under control. *Pastures*—Were very good, and where lime had been used, the effect was very noticeable on the early and late extra bite. *Live Stock*—Cattle and sheep stocks continued to thrive well and were free from any disease ; prices for sheep were poor, but cattle continued to be in good demand, especially dairy stock from attested herds, of which there are now many on the island. *Clip of Wool*—About average, but prices giving much dissatisfaction.

LANARKSHIRE (Upper Ward). *Wheat*—Only small quantities grown. *Barley*—None grown. *Oats*—45 to 70 bushels per acre ; grain and straw of excellent quality ; seed sown, 5 to 6 bushels per acre. *Harvest*—Commenced end of August ; perfect harvest

weather. *Hay*— $1\frac{1}{2}$ to 3 tons per acre ; a lighter crop than the previous year's, but well secured ; very dry weather in June. *Meadow Hay*—Heavier than last year and well secured. *Potatoes*—A bumper crop, 8 to 12 tons per acre ; lifted and pitted in perfect condition ; no disease. *Turnips*—A great crop, 20 to 30 tons per acre ; no resowing ; the best yield for years. *Insects*—No damage reported. *Weeds*—Very few and easily controlled. *Pastures*—Bare in June and July, but very good at back-end. *Live Stock*—Throve well, and kept free from disease. *Clip of Wool*—Quality moderate ; lighter than usual.

LANARKSHIRE (Middle and Lower Wards). *Wheat*—Grain threshed out similar to last year, 30 cwt. per acre, and 30 cwt. per acre of straw ; the crop was well secured, and both straw and grain were in good condition ; seed sown, English, 3 bushels, and Scotch, 4 bushels per acre. *Barley*—None grown. *Oats*—Similar to last year ; straw still short, but crop threshed well, from 30 to 35 cwt. per acre ; straw, 20 to 25 cwt. per acre ; the sample of both grain and straw can be termed first quality. *Harvest*—Began generally in the second week of August, and in the later districts about the beginning of September. *Hay*—Crop well secured, but yield not equal to the previous year's, except where heavily manured ; yield, 35 to 45 cwt. per acre. *Meadow Hay*—Yield at least equal to that of last year, and the quality in most cases superior. *Potatoes*—The crop was larger than last season's and yielded at least 9 tons per acre ; the tubers were larger in size, and no disease was visible at time of pitting ; no new varieties planted as the district is not suitable for seed-growing. *Turnips*—Yield better than last year, 30 tons per acre ; the crop brairded well, and no second sowing required. *Insects*—No injury to crops recorded. *Weeds*—No damage caused, the position being similar to the previous year. *Pastures*—Generally speaking, pastures were bare throughout the grass season, due largely to the heavy stocking brought about by the Government's ploughing-up policy. *Live Stock*—With the shortage of pasture and the limited supply of concentrated feeding-stuffs, cattle and sheep did not thrive so well as in the previous year ; the milk yield of dairy stock was not up to the average. There was no disease among cattle and sheep. *Clip of Wool*—Scarcely an average one for this district.

RENFREWSHIRE. *Wheat*—On the better wheat lands a good crop, and on light lands, indifferent ; yield of grain on the former lands, 25 to 35 cwt. per acre, and on the latter, 18 to 25 cwt. per acre ; straw, 20 to 30 cwt. per acre ; seed sown, 3 to 4 bushels per acre. *Barley*—None grown. *Oats*—A variable crop ; as with wheat, yield governed by type of soil ; on light lands crop suffered from drought ; yield of grain varied from 20 to 28 cwt. per acre ; yield of straw, similar to the previous year's. *Harvest*—Commenced on 7th August, about five days earlier than last year, and finished about the end of August, except for odd fields of wheat which were slow to ripen ; all crops secured in good order. *Hay*—An average crop on the better lands, but owing to drought slightly under average on poorer lands ; on the former lands, yield from 2 to $2\frac{1}{2}$ tons per acre ; on the latter, from 1 to $1\frac{1}{2}$ tons per acre ; crop secured early and in good order ; a larger acreage of second cut secured than for many years past. *Meadow Hay*—Little grown, but crop secured in good order. *Potatoes*

—Again an exceptionally good crop with yields similar to those of last year; 10 to 13 tons per acre, of both second earlies and main crop (principally British Queen and Kerr's Pink); Golden Wonder also a good crop with yields up to 10 tons per acre; no disease and no new varieties reported. *Turnips*—A good crop, 25 to 35 tons per acre; braird slow, due to drought in May and June; odd cases of resowing reported. *Insects*—Turnip-fly and cabbage maggot did more damage than usual, due to dry weather. *Weeds*—Not troublesome and easily controlled when labour available. *Pastures*—Similar to last year, checked by drought until mid-July; thereafter came away and grazed well until end of year. *Live Stock*—Did well, but early scarcity of grass affected milk yield, and scarcity of artificial feeding-stuffs caused both sheep and cattle to be marketed in rather poorer condition than usual; no outbreaks of disease reported. *Clip of Wool*—Average for quantity and quality.

ARGYLLSHIRE (Lochgilphhead). *Wheat*—Practically none grown. *Barley*—Practically none grown. *Oats*—A good crop, but it suffered from a wet harvest; 25 to 30 bushels of grain, and about 20 cwt. of straw per acre; seed sown, 5 to 6 bushels per acre, according to variety. *Harvest*—Began about the usual time. *Hay*—The best crop for many years; average 30 cwt. per acre, but on good farms there were yields of over 40 cwt. per acre; quality excellent. *Meadow Hay*—Was more productive than in 1939. *Potatoes*—Not so good as last year; 5 to 6 tons per acre; no reports of disease, and no extensive planting of new varieties; Kerr's Pink continued to be the favourite. *Turnips*—About the same as last year, 20 to 25 tons per acre; crop braird well on the whole, and there was not much resowing. *Insects*—No damage experienced. *Weeds*—No great damage observed. *Pastures*—Growth and quality similar to the previous season's. *Live Stock*—Did well and were free from disease. *Clip of Wool*—Average.

ARGYLLSHIRE (Kintyre). *Wheat*—About 10 acres more grown than in 1939; seeding was earlier, under more favourable conditions; about $3\frac{1}{2}$ bushels sown per acre; yield, 25 to 30 cwt. per acre. *Barley*—A good crop and got in good condition; yield, 20 to 24 cwt. per acre; seed sown, about 4 bushels per acre; straw rather heavier and stood well. *Oats*—A considerably larger acreage grown, with some late sowings owing to wet weather and shortage of labour; yield of grain, 20 to 25 cwt. per acre, of good quality; straw yield heavier than last year's; lodging more prevalent, especially in old lea; seed sown, 5 bushels per acre. *Harvest*—Started about same time as in previous year, but was slower to finish owing to unfavourable weather conditions. *Hay*—Heavier crop of seed hay, well got; yield, 30 to 35 cwt. per acre; more western woth grown, with yields of 40 to 50 cwt. per acre, giving in some cases second cuts at about half-weight. *Meadow Hay*—Yields heavier than last year and got in good condition; average yields, 28 to 32 cwt. per acre. *Potatoes*—Early crop planted later than last year owing to snow and frost; yields, 5 to $5\frac{1}{2}$ tons per acre; main crops very good, yielding average of about 8 tons per acre; crops were healthy and vigorous and showed little sign of disease. *Turnips*—Crop equal to that of 1939, and in some districts better; good average yield, 20 to 28 tons per

acre; crops braided well; finger-and-toe and dry-rot less prevalent; Monkwood the most popular variety. *Insects*—Little damage reported. *Weeds*—Made little progress owing to the season being good for cleaning the land; docks very prevalent in grassland. *Pastures*—Grass came earlier than usual, but did not keep up owing to dry weather conditions in mid-summer and many floods in late autumn. *Live Stock*—Cattle thrive fairly well and were free from disease; sheep stocks suffered heavy losses (from 10 per cent to 50 per cent) through snowstorm in February; fairly free from disease. *Clip of Wool*—About $\frac{1}{2}$ lb. per fleece less than last year; quality below average.

ARGYLLSHIRE (Islands of Islay, Jura, and Colonsay). *Wheat*—None grown. *Barley*—None grown. *Oats*—Again a good crop, producing 43 bushels per acre (42 lb. per bushel); straw shorter than usual; seed sown, 5 bushels per acre. *Harvest*—Began on 15th August and dragged on until 20th October; yield of grain was good in quantity and quality, but harvesting weather was exceptionally poor. *Hay*—Was an improvement on the last two years and yielded about 22 cwt. per acre for ryegrass, and about 32 cwt. per acre for clover; there was also an improvement in quality. *Meadow Hay*—Was also more productive than last year. *Potatoes*—Another good year; yield, $8\frac{1}{2}$ tons per acre; although weather was mainly broken, a few fine days permitted good harvesting; the main crop was not unduly affected by insects or disease; the usual varieties only were grown. *Turnips*—Also did well, yielding $16\frac{1}{2}$ tons per acre, of good root quality; the crop braided well, and although in the case of some early sowings a second proved necessary, late sowings were general and did well. *Insects*—No undue damage was reported, and was, if anything, below the average. *Weeds*—Were not so troublesome, and damage was less than usual. *Pastures*—Were an improvement on last year. *Live Stock*—Throve well; cattle kept free from disease, and although maggots gave trouble with sheep until August, this was not so prolonged as usual. *Clip of Wool*—Was of good quality and of average weight.

STIRLING DISTRICT.

DUMBARTONSHIRE (Upper). *Wheat*—None grown. *Barley*—None grown. *Oats*—A fair crop, but straw rather short; seed sown, 6 bushels per acre. *Harvest*—Started on 6th August, the earliest in the recollection of the reporter. *Hay*—Was much the same as last year, but was well got. *Meadow Hay*—Was light, but well got. *Potatoes*—Were a good crop, fully 8 tons per acre; they were free from disease; no new varieties planted. *Turnips*—Were a good crop, about 24 tons per acre; crop braided well; no resowing. *Insects*—No damage recorded. *Weeds*—No injury caused owing to dry weather in June. *Pastures*—Were slow in May and June, afterwards they were good and lasted long. *Live Stock*—Throve well; cattle and sheep kept free from disease. *Clip of Wool*—Was considerably under the average.

DUMBARTONSHIRE (Lower). *Wheat*—A good crop both for quantity

and quality ; yield, about 45 bushels per acre, harvested in excellent condition ; straw, about 25 cwt. per acre ; seed sown, 3 to 4 bushels per acre. *Barley*—None grown. *Oats*—Suffered from drought in the early summer, but improved before harvest, and yielded about 48 bushels per acre of good quality grain ; straw, about 22 cwt. per acre ; secured in good condition. *Harvest*—About a week earlier than usual ; weather was exceptionally favourable in being cool and breezy. *Hay*—Ryegrass was an average crop of first-class quality ; yield, about 35 cwt. per acre. *Meadow Hay*—Much the same quantity as last year, and was secured in good condition. *Potatoes*—The best crop for many years, about 8 tons per acre ; exceptionally free from disease and had a long growing season ; no new varieties planted. *Turnips*—Turnips and swedes braided well, and no second sowing was necessary ; the yield was about 18 tons per acre, very free from disease. *Insects*—All crops were exceptionally free from attacks. *Weeds*—The dry weather during the early summer enabled weeds to be mastered easily, and less damage than usual resulted. *Pastures*—Were very bare during the early months of grazing, but improved from July onwards. *Live Stock*—Did very well on the pastures during autumn, and the absence of frost prolonged the grazing season ; mastitis was prevalent among back-calving cows ; otherwise no very serious attacks of disease were noticed. *Clip of Wool*—The quality was up to the average, but the fleece was much lighter than usual.

STIRLINGSHIRE (West). *Wheat*—Very little grown ; the braird was affected by snow and frost, and the crop looked thin when growing, but threshed fairly well, considering the circumstances ; yield, about 20 cwt. per acre ; quality, very good ; seed sown, 4 bushels per acre. *Barley*—None grown. *Oats*—Record yield, up to 35 cwt. per acre ; average yield, 25 to 30 cwt. per acre ; quality excellent ; seed sown, 5 bushels per acre. *Harvest*—Began about eight or ten days earlier than average starting date. *Hay*—Ryegrass, clover, and timothy, quality excellent ; quantity, average. *Meadow Hay*—A little less productive than last year. *Potatoes*—Yield, up to 17 tons per acre, but average about 10 tons per acre ; no disease ; no new varieties known to be planted. *Turnips*—Average yield, 25 to 30 tons per acre ; quality good ; braird excellent ; no resowing. *Insects*—No damage to record. *Weeds*—Absent in white crops ; also in turnip crop until about July, when redshank appeared. *Pastures*—Growth below average ; quality good. *Live Stock*—Did very well and were fairly free from disease in general, but udder trouble still prevalent to about the same extent as last year. *Clip of Wool*—Quality good ; quantity average.

STIRLINGSHIRE (East). *Wheat*—About 40 bushels per acre ; good crop ; straw, about 20 cwt. per acre ; seed sown, 4 bushels per acre. *Barley*—About 32 bushels per acre ; fair crop ; straw, about 16 cwt. per acre. *Oats*—About 44 bushels per acre ; good crop ; straw, about 16 cwt. per acre ; seed sown, 5 bushels per acre. *Harvest*—Started ten days earlier than usual, and continued in good weather ; in fact, the best harvest for some years. *Hay*—Fair average crop and well secured ; ryegrass, about 30 cwt. per acre ; timothy, about 45 cwt. per acre. *Meadow Hay*—About an average crop. *Potatoes*—Good

quality and an average crop. *Turnips*—Good average crop; no resowing. *Insects*—Nothing unusual in way of damage. *Weeds*—About the usual amount of injury. *Pastures*—Showed average growth. *Live Stock*—Did quite well; cattle and sheep quite free from disease. *Clip of Wool*—Average.

CLACKMANNANSHIRE. *Wheat*—The braird was good; the crop very good; 40 to 45 bushels per acre; straw, 30 to 35 cwt. per acre; seed sown, 4 bushels per acre. *Barley*—A good crop; 40 to 48 bushels per acre; seed sown, 3 to 4 bushels per acre; straw, 30 to 35 cwt. per acre. *Oats*—A good crop with plenty of straw; yield, 40 to 45 bushels per acre; weight, 40 to 42 lb. per bushel. *Harvest*—Began at the usual time, and was completed under exceptional conditions, the weather being exceedingly good. *Hay*—Was a good crop, 40 to 45 cwt. per acre; quality very good. *Meadow Hay*—Very little grown. *Potatoes*—Kerr's Pink, 6 to 7 tons per acre; Golden Wonder, 5 to 6 tons per acre; very little disease. *Turnips*—A good crop, 20 to 30 tons per acre; braided well; very little damage by turnip-fly, and very little resowing. *Insects*—Very little damage; much less than usual. *Weeds*—Very little injury caused. *Pastures*—Were very good, especially at the beginning of the season, although they became rather dried up later. *Live Stock*—Did well; cattle and sheep were free from disease. *Clip of Wool*—A fair average.

PERTH DISTRICT.

PERTHSHIRE (Central). *Wheat*—More sown than usual; yield good, 35 to 40 bushels per acre; straw, 22 to 24 cwt. per acre. *Barley*—Very little grown. *Oats*—Very much larger acreage owing to the war; yield of grain very good, 48 to 64 bushels per acre; straw, 20 to 22 cwt. per acre; both of very fine quality. *Harvest*—Started the same day as last year, 15th August; finished 5th September; exceptionally fine weather; all secured in the best order for many years. *Hay*—Good, except on light lands which suffered from prolonged dry weather in May; yields varied very much; 20 to 40 cwt. per acre. *Meadow Hay*—Only fair, but well got. *Potatoes*—A very good crop, 8 to 9 tons per acre; no disease; lifted in very fine order. *Turnips*—The best crop for a very long time; swedes, 25 to 30 tons per acre; yellows, 20 to 30 tons per acre; braided well; no second sowing and very free from disease. *Insects*—No damage done. *Weeds*—No injury caused. *Pastures*—Only fair; weather rather dry. *Live Stock*—Did well except on very light land, which was very bare. Cattle and sheep were free from disease. *Clip of Wool*—A good average and of good quality.

FIFESHIRE (Middle and Eastern). *Wheat*—Excellent crop of both grain and straw; 32 to 48 bushels per acre; rather better than last year; seed sown, 3 to 4 bushels per acre. *Barley*—Good crop of excellent quality; from 40 to 60 bushels per acre, secured in fine order; seed sown, 3½ bushels per acre. *Oats*—Good crop of excellent quality; on light land some crops were light; yield, 50 to 80 bushels per acre. *Harvest*—Was early and had excellent weather all through; began end of July and was almost all finished in a month. *Hay*—About same as last year; excellent quality; about

2½ tons per acre. *Meadow Hay*—None grown. *Potatoes*—Rather better than last year; Majestic about 10 tons per acre on good land; not many new kinds grown; very free from disease. *Turnips*—Crop very good; did not braird well, but came away later and finished up one of the best for many years; 20 to 30 tons per acre. *Insects*—Damage less than usual. *Weeds*—Less injury than usual. *Pastures*—Were very good; grass was scarce in June, but plentiful afterwards. *Live Stock*—Cattle thrive well, and cattle and sheep were free from disease. *Clip of Wool*—Average.

FIFESHIRE (Western). *Wheat*—Winter and spring wheats were sown under ideal conditions, and, though the dry spring and summer retarded growth, the yields were satisfactory; average crop, 28 to 36 bushels per acre; straw probably lighter in weight, but quality good; seed sown, 3 to 4 bushels per acre. *Barley*—Where grown on suitable land returned an average yield, 28 to 34 bushels per acre; grown on inferior land the returns were in cases disappointing; quality, however, was good; straw, good quality, but lighter in weight; seed sown, 3 to 4 bushels per acre. *Oats*—Suffered during the dry spring; results were satisfactory and the quality very good; yield, 40 to 50 bushels per acre, and in some cases up to 68 bushels per acre; straw of excellent feeding quality and average weight; seed sown, 5 to 6 bushels per acre. *Harvest*—1940 will be remembered as one of the best for many years; started in the middle of August and was general in the first week of September; there was little or no interruption by broken weather; grain secured in good condition. *Hay*—Dry weather during early summer reduced the weight of ryegrass hay, which was secured earlier than usual; yields were lighter than average; below 40 cwt. per acre. *Meadow Hay*—Also lighter, and as the weather was wet during July, there was difficulty in securing the crop. *Potatoes*—Crop was easily secured and the tubers dry and of good quality; yield, 5 to 8 tons per acre; no reports of disease. *Turnips*—Seed was long in brairding owing to dry weather, and the plants could only be thinned in patches; what looked like being a disappointing crop bulked above expectations, and there has been sufficient for stock; very little second sowing necessary. *Insects*—Crops all free from insect pests. *Weeds*—The dry season prevented growth of weeds, and the land was easily cleaned. *Pastures*—Were sufficient for all stock. *Live Stock*—Grazed well; cattle and sheep free from disease. *Clip of Wool*—Average yield, secured in good order, and of good quality.

PERTSHIRE (Eastern). *Wheat*—Winter wheat was a good crop, in fact the best cereal crop of the season, as it withstood the drought; yield, 35 to 50 bushels per acre; seed sown, 4 to 5 bushels per acre; samples very good. *Barley*—An average crop, but not a large acreage grown; yield, about the same as last year, 40 to 42 bushels per acre; seed sown, 3 to 4 bushels per acre; samples good. *Oats*—Were a good crop, although short of straw; samples very good colour, but inclined to be a little light in weight; threshed very well, 42 to 72 bushels per acre; seed sown, 4 to 6 bushels per acre. *Harvest*—Began about the beginning of August and was the best in living memory; the absence of morning dews and the help of fine drying winds made it an ideal harvest; even with depleted staffs the extra

acreage was easily managed within six weeks. *Hay*—An average crop, 40 cwt. per acre, in some districts a little more; ryegrass grazed by sheep in the spring was a poor crop owing to the dry weather in May. *Meadow Hay*—An average crop; quality good. *Potatoes*—Yield, 6 to 10 tons per acre, a little better than last year's, which was a good crop; no disease; kept very well in pits; a very good, paying crop; very few new varieties grown. *Turnips*—The crop was very good; in fact, a bumper; swedes did not look well in July and August, but seemed to get the rain at the proper time; they braided and grew very well; yield, 30 to 40 tons per acre; yellows, also a good crop, except where late sown, when there was difficulty with braid. *Insects*—No damage reported. *Weeds*—Being a good, dry summer, crops were easily kept clear. *Pastures*—Grass came early and did well; it got a little bare in August and September, but came away later and lasted to well into November owing to the absence of frost. *Live Stock*—Did very well where land was not too heavily stocked; cattle and sheep were free from disease, except for a few cases of trouble with early lambing Half-Bred ewes. *Clip of Wool*—Average.

PERTSHIRE (Western). *Wheat*—Over average crop of good quality; yield, 40 to 50 bushels per acre; straw, 25 to 30 cwt. per acre; secured in excellent order; seed sown, $3\frac{1}{2}$ to 4 bushels per acre. *Barley*—Very little grown. *Oats*—Good crop; above average, except on a few fields sown late and affected by dry spring; yield, about 45 to 50 bushels per acre, but good fields sown with new varieties yielded up to 100 bushels per acre; straw, very good quality, 20 to 30 cwt. per acre; stood well; seed sown, 5 to 7 bushels per acre, according to variety. *Harvest*—Commenced about usual time, middle of August; one of the best harvests on record, wheat being stacked off the binder; in many cases wheat and oats were threshed out of the stook, which is unusual for this district. *Hay*—Timothy, good crop, 60 to 80 cwt. per acre, green cut; about usual amount left for seed, but threshed well under average; secured in fair order; ryegrass, fair crop on better soil, light on poor ground; strong second crop of clover; both ryegrass and second crop secured in excellent condition. *Meadow Hay*—Average crop; well got. *Potatoes*—Average crop of 7 to 10 tons per acre; better than last year; earlies lifted in good weather; main crop in broken weather; very little disease; no new varieties planted. *Turnips*—Over average crop of 25 to 30 tons per acre; some very heavy crops and extra large roots; seed braided well, and there were not many resowings. *Insects*—Very little damage done except by timothy-fly grub, which was much worse than usual. *Weeds*—Gave very little trouble. *Pastures*—Average; too dry in some districts. *Live Stock*—Did well on the average; cattle and sheep were free from disease. *Clip of Wool*—Average, and of good quality.

PERTSHIRE (Highland). *Wheat*—Not generally sown; only a few acres grown on suitable farms. *Barley*—Only small patches grown for stock; weight light. *Oats*—Crop about average; straw short, but of very good quality; natural weight of grain about 42 lb. per bushel; seed sown, 6 to 8 bushels per acre, according to variety. *Harvest*—Began in third week of August, somewhat earlier than usual, and in most cases was completed within five weeks,

in fine weather conditions. *Hay*—Crop average; of good quality and well secured; 30 cwt. per acre. *Meadow Hay*—Average as to quantity and quality; somewhat spoilt by broken weather in later stages. *Potatoes*—A very fine crop secured under exceptionally good weather conditions; about 8 tons per acre; no disease apparent; new varieties not planted to any extent. *Turnips*—Also a very good crop; braided well and quickly where sown early, and little second sowing required; about 20 tons per acre. *Weeds*—Very few, and where they appeared were easily dealt with. *Pastures*—Of average growth and quality. *Live Stock*—Throve well, and were generally free from disease. *Clip of Wool*—Quality and quantity about average; weather conditions fine during clipping season.

ABERDEEN DISTRICT.

ANGUS (Western). *Wheat*—34 bushels per acre; straw and grain very good quality; seed sown, 3 to 4 bushels per acre, drilled. *Barley*—36 bushels per acre; straw and grain very good quality; seed sown, 3 to 4 bushels per acre, drilled. *Oats*—48 bushels per acre; straw and grain excellent quality; seed sown, 4 to 6 bushels per acre, according to variety and district. *Harvest*—Started early in August in good weather, which continued throughout, and harvest was one of the shortest for years. *Hay*—3 tons per acre; all got in excellent order and quality. *Meadow Hay*—Very little grown. *Potatoes*—7 to 8 tons per acre; no disease to speak of; lots burned down; lifting started in September. *Turnips*—20 tons per acre; crop braided well, although a little resowing took place owing to dry weather. *Insects*—The damage was less than in previous years, and negligible. *Weeds*—Very little damage reported; less than usual. *Pastures*—Average growth and quality; only short towards end of season. *Live Stock*—Throve well; both cattle and sheep were very free from disease. *Clip of Wool*—Quality good, and crop just about the average.

ANGUS (Eastern). *Wheat*—A satisfactory crop, 46 to 48 bushels per acre of very good quality; secured in excellent condition; straw stood up well, but not quite so tall as usual; seed sown, $3\frac{1}{2}$ to 4 bushels per acre. *Barley*—Crop threshed out rather over average, from 50 to 60 bushels per acre; grain of good quality, colour, and satisfactory weight; straw shorter than usual; secured in fine condition; seed sown, about $3\frac{1}{2}$ bushels per acre. *Oats*—A good crop, well secured; straw of excellent feeding quality and average bulk; grain showed best colour and gave highest weight for several years; threshed out on the good land from 80 to 96 bushels per acre; seed sown, according to variety, $4\frac{1}{2}$ to 6 bushels per acre. *Harvest*—Began about the usual time, 10th to 12th August. *Hay*—Owing to the extra dry weather in June, was not so heavy a crop as usual, just about 2 tons per acre, but it was secured in very fine order; feeding value excellent. *Meadow Hay*—Practically none grown. *Potatoes*—Crop good and very sound; disease scarcely present; yield, 10 to 12 tons per acre of sound tubers, seed, and ware, and occasional crops of even more; new varieties, none of outstanding merit. *Turnips*—Turnips and swedes were disappointing at the

end of August, but, with rain at the end of September and showery, growing weather afterwards, they improved many tons per acre, and by December they had become one of the heaviest crops for years; 30 to 35 tons per acre; some second sowing was needed where land got too dry, and some irregular brairds occurred from the same cause. *Insects*—Not much damage caused by insects, but as usual a field here and there was affected by finger-and-too, mostly caused by bad management. *Weeds*—During summer were easily overcome, but when rain came after harvest green crops in many cases got dirty with charlock, 'fat hen,' and other such weeds; couch, where present, showed strong growth. *Pastures*—Were good, though a little bare about July, but later improved greatly, and stood out very well till end of October; white clover was abundant. *Live Stock*—Owing to the dry warm summer stock of all kinds did very well, and fattened better than usual, even though concentrated food-stuffs were shorter than usual; no disease of any importance was noted. *Clip of Wool*—Quality about average; weight under average.

KINCARDINESHIRE. *Wheat*—22 to 30 cwt. per acre; crop better than last year; grain and straw very good quality; threshed above the average; seed sown, 4 to 5 bushels per acre. *Barley*—16 to 30 cwt. per acre, depending on the district; lighter in Deeside and heavier in St Cyrus district; quality of grain and straw very good, except on light land where it was affected by excessively dry weather; seed sown, 3 to 5 bushels per acre according to variety. *Oats*—12 to 36 cwt. per acre depending on the locality; good crops on good land, but on light land affected by drought, and much second growth appeared; grain and straw of exceptionally good quality; seed sown, 4 to 8 bushels according to variety. *Harvest*—Began about middle of August, and was completed in almost every district in record time; best harvest for many years. *Hay*—1½ to 2½ tons per acre; crop not so good as usual in the Stonehaven and Deeside districts; suffered from drought; St Cyrus district was up to the average, and in the Howe of the Mearns good; in Stonehaven and Deeside districts crops not well secured, owing to wet weather in July, but in excellent condition in the Mearns. *Meadow Hay*—None grown. *Potatoes*—7 to 12 tons per acre; yield better than last year; very little disease; no new varieties. *Turnips*—18 to 30 tons per acre; crop better than last year; quality good; brairded unequally owing to dry weather, and some resowing took place. *Insects*—No material damage done. *Weeds*—Were more prevalent among potatoes and turnips; averred to be due to the lack of labour. *Pastures*—During the early part of the year grass was scarce, especially where fully stocked, but after rain in July growth was abundant, and during the rest of the season. *Live Stock*—Did very well on pastures all through the season; cattle and sheep free from disease. *Clip of Wool*—Quality good; average yield.

ABERDEENSHIRE (Buchan). *Wheat*—Not much grown. *Barley*—Good crop, similar to last year; 40 bushels per acre. *Oats*—Good crop; splendid quality; 48 to 64 bushels per acre. *Harvest*—Started about the second week of August, and was one of the best on record. *Hay*—About 2 tons per acre; the crop cut in June well secured; that in July harvested in very bad condition. *Meadow*

Hay—None grown. *Potatoes*—Splendid crop; from 7 to 9 tons per acre; no disease. *Turnips*—Also a splendid crop, 15 to 20 tons per acre; braided well; no resowing. *Insects*—No trouble caused. *Weeds*—No damage to speak of. *Pastures*—Bare in June; afterwards, great growth of good quality. *Live Stock*—Did well, and there was no disease among cattle and sheep. *Clip of Wool*—Average.

ABERDEENSHIRE (Central). *Wheat*—Much the same as last year, possibly not so good; with a much wider range than in a normal year; yield, 16 to 20 cwt. per acre; quality under average; also more varied than in average seasons. *Barley*—16 to 18 cwt. per acre; quality varied, and of a much wider range than in a normal season; bushel weights, from 46 to 56 lb.; seed sown, 4 bushels per acre. *Oats*—15 to 20 cwt. per acre; quality very varied and also of a wider range than in a normal season; seed sown, from 4 to 6 bushels per acre; varieties of foreign origin required more seed than native varieties, which tillered better. *Harvest*—Began about the usual time, and finished in the period between the middle and end of September; weather was not very seasonable, with too much rain. *Hay*—Quantity and quality much about the same as last year, showing greater variation than in a normal season. *Meadow Hay*—Not very much grown; crop probably rather greater than last year. *Potatoes*—5 to 8 tons per acre, and of very good quality; no report of disease; no new varieties planted; for general crop Kerr's Pink more largely grown than any other, and for earlies, Golden Wonder. *Turnips*—Crops varied widely, some good, but some very poor; on the whole, hardly an average; surface weeds very abundant. *Insects*—No damage reported. *Weeds*—Crops were injured to a greater extent than usually, the land being often too wet; surface weeds mostly were the chief cause of trouble. *Pastures*—Generally were better than in the previous year; clover was not very abundant. *Live Stock*—Throve and did quite well; no complaint of any disease was reported. *Clip of Wool*—Quality of wool varied, and the whole clip was under average of quality and quantity.

ABERDEENSHIRE (Strathbogie). *Wheat*—None grown. *Barley*—Quantity grown below average; crops were fair; yield, 28 to 38 bushels per acre, weighing 52 to 54 lb. per bushel; 4 to 5 bushels of seed per acre were sown. *Oats*—Over all, crops were much better than last year and very well harvested—the best for many years; the weather was very favourable and the yield above average, being 40 to 48 bushels per acre, weighing 39 to 42 lb. per bushel; straw was of excellent quality, but a little more of it would have been a boon as paper-mills were buying up any available surplus, and farmers short had difficulty in getting supplies. *Harvest*—Very good; best for many years; in late districts, however, weather broke before all crops were secured. *Hay*—Not much grown; there would be a market for more. *Meadow Hay*—None grown. *Potatoes*—Excellent quality and yield, much above average; staple crop, Kerr's Pink; no new varieties grown; quality above average. *Turnips*—Crop very satisfactory and no resowing necessary; worm was found in yellows, however. *Insects*—No trouble from grub or insect pests,

except worm-eaten yellow turnips in some areas. *Weeds*—No trouble; weather very favourable for cleaning the land. *Pastures*—Early pasture abundant, but did not last so long into the autumn as in some years. *Live Stock*—Did well on pasture; no disease among cattle and sheep. *Clip of Wool*—Good quality, and quantity fair, 6 to 8 lb. per sheep in some places. *General Remarks*—Continuous frost made sowing late, but this did not seem to affect early maturing of crops. In this district 1940 was one of the best years for some time. There was a scarcity of straw and turnips, and in the early part of the year farmers were hard put to it to get fodder before weather permitted their letting cattle out to grass. Approximately 20 acres of flax was grown successfully in the area.

BANFFSHIRE (Lower). *Wheat*—Quantity sown, about the same as last year, yielding 45 to 50 bushels per acre; natural weight, 57 to 60 lb. per bushel; straw, about 25 cwt. per acre; seed sown, $4\frac{1}{2}$ to 5 bushels per acre. *Barley*—Again a poor crop, somewhat similar to last year's, yielding about 30 bushels per acre; natural weight, 54 lb. per bushel; straw, about 20 cwt. per acre of very fine quality; seed sown, 4 bushels per acre. *Oats*—A very good crop, yielding 56 bushels per acre; in some cases up to about 70 bushels per acre; straw, which was of excellent quality, 28 to 30 cwt. per acre; seed sown, 6 to 7 bushels per acre. *Harvest*—Began about a week earlier than last year; all cereal crops were harvested in fine order. *Hay*—Quantity was slightly more than last year, yielding about 35 to 40 cwt. per acre; ryegrass and clovers were abundant and of better quality. *Meadow Hay*—Practically none grown. *Potatoes*—A better crop than last year's, and of excellent quality, yielding up to 12 tons per acre for the later varieties; no new varieties planted. *Turnips*—An average crop, better than the previous year's, and of good quality; 15 to 18 tons per acre; the crop braided well; there was no resowing. *Insects*—No crops were injured. *Weeds*—No damage caused. *Pastures*—Were fairly good throughout the season. *Live Stock*—Did very well; cattle and sheep were free from disease. *Clip of Wool*—Quality good; average yield.

BANFFSHIRE (Upper). *Wheat*—None grown. *Barley*—Very little grown; only an acre or so for special needs of stock. *Oats*—Good average crop both as regards grain and straw; 40 to 42 bushels per acre; bushel weight about the standard, 42 lb.; seed sown, generally 6 bushels per acre. *Harvest*—Commenced rather earlier than usual, about the end of August. *Hay*—Crop rather poor, as May and June kept too dry; clover scarce; 1 to $1\frac{1}{2}$ tons per acre and even loss in some cases. *Meadow Hay*—None grown. *Potatoes*—A bumper crop, the best for a few years; no disease noticeable; main crop everywhere Kerr's Pink. *Turnips*—A good yield of sound roots, 12 to 15 tons per acre; braiding slow, but no second sowing required. *Insects*—No serious damage done to any crops; absence of the turnip-fly noted. *Weeds*—Plentiful, but dryness of weather in May and June soon shrivelled them up. *Pastures*—Quite up to the average and kept on well. *Live Stock*—Every kind thrived well; no disease recorded. *Clip of Wool*—Very good quality; quantity slightly above the average of preceding year.

INVERNESS DISTRICT.

MORAYSHIRE. *Wheat*—An average crop; 38 bushels per acre; quality good; some put on the market rather soft and spoiled owing to stacks not being well built and unthatched; straw good, 30 cwt. per acre; seed sown, 3 to 4 bushels per acre. *Barley*—On light land a good deal of burning took place during the dry weather in June, resulting in much second growth; on good land a fair crop was harvested of good quality; 40 bushels per acre; weight from 54 to 58 lb. per bushel; straw, 23 cwt. per acre; seed sown, 3 to 4 bushels per acre. *Oats*—The same conditions applied to oats, burning on light land; on good land a fine crop, which yielded better than last year; from 30 to 70 bushels per acre, weighing from 42 to 45 lb. per bushel; quality good; straw well got and of fine quality, 25 cwt. per acre. *Harvest*—Began a week later than last year. *Hay*—Below average in Lower Moray, 35 to 40 cwt. per acre; in the uplands, 23 to 25 cwt. per acre; quality good, well mixed with clover. *Meadow Hay*—Little grown. *Potatoes*—Slightly better than last year; about 6 tons per acre; a bigger proportion of seed size; quality good; very little disease; no new varieties. *Turnips*—Did not promise well to begin with, but later developed well and finished a full crop; there was not a great deal of second sowing, and not much complaint of disease or rotting; yield, from 10 to 30 tons per acre. *Insects*—Less damage than usual. *Weeds*—Crops less severely injured than usual. *Pastures*—Got very bare for a period; they improved later, but were not of average growth. *Live Stock*—Did well; cattle and sheep were free from disease. *Clip of Wool*—Average.

NAIRNSHIRE. *Wheat*—Little grown. *Barley*—As poor a yield as last year's; 24 bushels, or less, per acre; seed sown, $3\frac{1}{2}$ to 4 bushels per acre. *Oats*—About 40 bushels per acre; seed sown, 6 to 7 bushels per acre; a good deal of late growth amongst the crop. *Harvest*—Began at the usual time. *Hay*—About 15 cwt. per acre. *Meadow Hay*—None grown. *Potatoes*—About 8 tons per acre; no disease. *Turnips*—A good yield compared with last year's; no second sowing. *Insects*—No injury caused. *Weeds*—No injury reported. *Pastures*—Average. *Live Stock*—Throve well; cattle and sheep were free from disease. *Clip of Wool*—About average.

INVERNESS-SHIRE (Inverness). *Wheat*—A good crop; return, about 47 bushels per acre on good wheat land. *Barley*—A poor crop; yield, generally much below average; about 26 bushels per acre; straw, short. *Oats*—A very variable crop; a fair return on good land, but very poor on light ground; yield, about 38 bushels per acre; straw very short, but of excellent quality. *Harvest*—Particularly good; started much earlier than usual, and finished in record time; grain secured in excellent condition. *Hay*—Under an average crop, with about 25 per cent lost through bad weather in July. *Meadow Hay*—A poor crop. *Potatoes*—Generally a very good crop; about 6 tons per acre of very good quality. *Turnips*—Some very poor returns; drought in May and June, followed by an abnormally wet July, ruined the crop on many farms. *Insects*—A good deal of damage by green-fly. *Weeds*—Very difficult to control owing

to the wet month of July. *Pastures*—Mainly fair, owing to drought in May and June. *Live Stock*—Did fairly well, except that lambs were short of condition due to want of milk in May and June; no complaints of disease among cattle and sheep. *Clip of Wool*—Average quality.

INVERNESS-SHIRE (Skye). *Wheat*—None grown. *Barley*—None grown. *Oats*—Fairly good crop; straw a good bulk, and grain fairly good. *Harvest*—Began about the usual time, or rather later, commencing at the beginning of September. *Hay*—Quantity about the same as last year, but quality not so good. *Meadow Hay*—Crop fully as productive as in the previous year, but hardly any was secured in good condition, and much was lost owing to continuous rains. *Potatoes*—A large crop of good quality at time of lifting; a large proportion of tubers diseased owing to long spell of wet weather, but even after allowing for diseased tubers it was a good crop. *Turnips*—Scarcely any grown; a few plots of swedes were very unsound. *Insects*—Some damage (unidentified) to potatoes and carrots. *Weeds*—Owing to excessive rains, were prevalent. *Pastures*—Were of good average growth during the season, and made a good start in the early part of it. *Live Stock*—On the whole, thrived just ordinarily well. There was not great evidence of disease in cattle and sheep; tick, however, was a severe infestation. *Clip of Wool*—The weight would be rather over average and the wool up to standard in quality.

INVERNESS-SHIRE (Lochaber). *Wheat*—None grown. *Barley*—None grown. *Oats*—Average crop; seed sown, about 6 bushels per acre. *Harvest*—Began about 20th August, and most crops were secured in good order; although the weather was not good, there was always a fair amount of wind, which kept corn crops from getting damaged. *Hay*—Crops were lighter and under average. *Meadow Hay*—Light, owing to cold weather and want of dew. *Potatoes*—Were not a heavy crop, just about average; very healthy; no signs of disease. *Turnips*—Very few grown, but in most cases were better than for some years, and there was not much sign of grub or maggot. *Insects*—Not so much damage as usual. *Weeds*—Were not so harmful as usual. *Pastures*—Were under average. *Live Stock*—Were back in condition during the whole season, owing to cold and continuously wet weather; live stock kept free from disease. *Clip of Wool*—Quality was quite good; but crop under the average in weight.

ROSS-SHIRE (Dingwall and Munlochy). *Wheat*—Very little grown, and practically none was threshed. *Barley*—Larger acreage grown; yield below average, 25 to 40 bushels per acre. *Oats*—Larger acreage grown; a good crop, both straw and grain; straw of exceptional quality; yield per acre was average. *Harvest*—Early, but prolonged in most cases on account of labour shortage. *Hay*—An average crop, but unfavourable weather affected the quality. *Meadow Hay*—Practically none grown. *Potatoes*—The yield was better than last year, and the acreage larger; no disease. *Turnips*—The crop generally was better than in 1939; did not come away well, but a favourable back-end increased the yield; some re-sowing; swedes, 15 to 20 tons per acre; yellows, 10 to 20 tons per acre. *Insects*—No word of damage by insects, but crows and pigeons have caused

considerable injury. *Weeds*—Most green crops dirtier than usual owing to scarcity of labour. *Pastures*—Average. *Live Stock*—Throve well; cattle and sheep have been free from disease. *Clip of Wool*—Average.

ROSS-SHIRE (Tain, Cromarty, and Invergordon). *Wheat*—On good land generally a good crop. *Barley*—Very light owing to exceptionally dry weather in May and June; 32 to 40 bushels per acre were the usual returns; general weight, about 54 lb. per bushel; grain in good condition. *Oats*—Excepting on middling land, were a good crop, threshed out well, and where harvested fairly early; straw very good; 44 bushels per acre, possibly under the average. *Harvest*—Began last week in August. *Hay*—Where not grazed was a good crop, but was considerably damaged in the cole by excessive wet. *Meadow Hay*—Little grown. *Potatoes*—Generally a good crop; fair average, 7 to 8 tons per acre. *Turnips*—Very irregular owing to dry weather in May; not so much maggot-fly as last year. *Insects*—Considerable damage by finger-and-toe disease. *Weeds*—Land fairly clean. *Pastures*—Cattle grazed well on the whole. *Live Stock*—Lambs did well during the early period although there was little grass, but not so well after the rain came in July; all lambs dosed for worms mainly with nicotine mixture. *Clip of Wool*—Generally good; fully above the average on arable land.

SUTHERLANDSHIRE. *Wheat*—None sown. *Barley*—Only a fair crop; was badly affected by the very dry weather in June; not grown very much in this county. *Oats*—A fairly good crop, but on light soil the dry weather in June retarded growth, and on very poor land there was a good deal of second growth after the rain came; straw was of very good quality. *Harvest*—Was early, commencing about 27th August, and by the beginning of September most places were busy cutting; all secured in good order early in October. *Hay*—A light crop, and the quality only fair, as weather was very wet at cutting-time; average about 1 ton per acre for the good land; on poor soil, 12 cwt. per acre. *Meadow Hay*—Was less productive than last year, and the quality only fair. *Potatoes*—Were a good crop, and averaged about 6 to 7 tons per acre on good land; there was practically no disease; no new varieties were planted. *Turnips*—Were not a heavy crop, but were healthy on most farms; average, about 15 tons per acre; they were slow to braird, and came very irregularly owing to the drought. *Insects*—Taken all over, crops were healthy; there was some complaint of grub, and the fly affected some fields of turnips, but injury was not serious. *Weeds*—The crops were not injured, and weeds were easily kept under control during the dry spell. *Pastures*—Were burnt badly on light land, but there was abundant growth in the later part of the year. *Live Stock*—Did very well, and both cattle and sheep were in good condition in the back-end, having kept very free from disease. *Clip of Wool*—Wool was of good quality, and a fair average crop.

CAITHNESS-SHIRE. *Wheat*—Small acreage grown; crops average; 60 bushels per acre; grain and straw average quality. *Barley*—An average crop; yield, 44 bushels per acre; grain and straw average

quality; seed sown, 4 bushels per acre. *Oats*—Crops similar to previous year; grain and straw good quality; average yield, 40 to 44 bushels per acre; straw, 2 tons per acre; seed sown, 4 to 7 bushels per acre. *Harvest*—Began at usual time; some fields were cut at the end of August; weather was favourable, and crops were rapidly secured in good condition. *Hay*—An average crop both as regards ryegrass and clover; early cut hay slightly damaged by rain; quantity, 2 to 3 tons per acre. *Meadow Hay*—A more productive crop than last year; quality was good and weather favourable. *Potatoes*—Yield was higher than last year; 7 to 8 tons per acre; tubers big and dry; small evidence of disease; not many new varieties planted. *Turnips*—Very similar to the previous season; average yield, 25 to 28 tons per acre; crop braided well; no resowing necessary. *Insects*—Very little damage experienced. *Weeds*—Crops not seriously injured; charlock and thistles were prevalent in corn crops and pastures. *Pastures*—Were better than last year; earlier and more rapid growth; abundant in summer and autumn months. *Live Stock*—Throve well on pasture; practically no disease among cattle and sheep; maggot-fly was troublesome in some flocks. *Clip of Wool*—Average and of good quality.

ORKNEY. *Wheat*—None grown. *Bere*—Yields: grain, 30 to 35 bushels per acre; straw, 25 to 35 cwt. per acre; bushel weight of grain, about 45 to 50 lb.; seed sown, about $3\frac{1}{2}$ bushels per acre. *Oats*—Yields various, from 30 to 60, or more, bushels per acre; normal yield, about 45 bushels per acre; bushel weight, 35 to 42 lb.; seed sown, 4 to 6 bushels per acre, depending on the variety. *Harvest*—Commenced a few days later than usual, and the weather during the cutting period was most unfavourable. *Hay*—Yield about average, say 30 to 40 cwt. per acre; in most cases clover was plentiful. *Meadow Hay*—About average. *Potatoes*—Yield about average, say 5 to 8 tons per acre; excessive wet weather during the summer somewhat impaired the quality; blight was prevalent in a number of districts; no new varieties grown. *Turnips*—Yield was considerably below average; the crop in a great many instances braided badly, and resowing had to be done because of dry weather and late frost; yield, 15 to 25 tons per acre. *Insects*—Only small damage to vegetable crops by cabbage-fly and carrot-fly. *Weeds*—Charlock and thistles prevalent in some districts. *Pastures*—Exceptionally good throughout the season. *Live Stock*—Made good progress; a few more cases of suspected grass-sickness reported throughout the season. *Clip of Wool*—Average in quality and quantity.

SHETLAND. *Wheat*—None grown. *Bere*—Good average crop; bushel weight, 50 to 54 lb.; yield of grain, 12 cwt. per acre. *Oats*—Average crop; marked superiority of lea oats over clean-land oats due to very dry spell in May and first half of June; bushel weight, 38 to 42 lb.; yield of grain, 13 to 15 cwt. per acre; seed sown, 4 to 6 bushels per acre. *Harvest*—Commenced if anything a little earlier than normal, bore harvest in first week of September, and oat harvest in the second week of September. *Hay*—The 'seeds hay' crop was good; slightly above normal both as regards yield and quality; 20 to 26 cwt. per acre. *Meadow Hay*—Due to weather conditions was very poor, both in yield and quality, in practically

all districts; crop definitely inferior to that of 1939. *Potatoes*—Yield, 5 to 8 tons per acre; crop slightly superior to that of previous year; very little disease; new varieties, such as Gladstone and Redskin, continued to be very satisfactory. *Turnips*—Good crop, slightly better than last year's; yield, 18 to 20 tons per acre; braird was very slow, though only in a few cases was resowing necessary. *Insects*—Damage was not severe, but rather more than usual; most was caused by the cabbage root fly, which was much more troublesome; attacks by cabbage moth caterpillars and turnip and carrot flies reported. *Weeds*—Damage done by weeds, such as charlock, spurrey, and shepherd's purse, was normal. *Pastures*—Similar to last year, though grazing period somewhat lengthened due to moist open weather in autumn. *Live Stock*—Did fairly well on pastures; little disease among cattle and sheep. *Clip of Wool*—Yield and quality average to good; great demand for Shetland wool; prices—moorit, 3s., white, 2s. 6d., black and grey, 2s. per lb.

THE WEATHER OF SCOTLAND IN 1940.

By W. A. HARWOOD, D.Sc.

THIS report consists of (1) a general description of the weather from month to month, and (2) a selection of rainfall returns in which each county of Scotland is represented by one or more stations. Temperature readings, unless otherwise stated, are from thermometers exposed in the regulation "Stevenson Screen."

JANUARY.

January 1940 will long be remembered for the intense cold. Severe wintry conditions prevailed throughout. For the country as a whole it was the coldest month since February 1895, and the coldest January since 1881. Precipitation was below normal despite exceptionally heavy snow in the last week.

Conditions during the first five or six days of January were associated with an anticyclone over Western Europe, winds being light and variable and weather cold and fine, but with local fog. After a few indeterminate days there was then a spell controlled mainly by Atlantic depressions, which gave southerly winds and gales, especially in the west. From the middle of the month an irregular alternation of these conditions occurred, terminating with a strong south-easterly type accompanied by much snow. There were gales on the 10th, 15th, 16th, 18th, 19th, and from the 25th to the 31st. A north-easterly gale on the 16th along the east coast was the most severe one. In this the mean speed reached nearly 60 miles per hour, and there were gusts of over 80 miles per hour.

Temperature was well below normal all over the country, and especially so in the south-west and on the Borders. The mean for the month at many stations in these districts was more than ten degrees lower than the normal. The only days of moderate temperature were the 7th, 8th, and 14th. During this milder spell temperature in the screen reached 52° F. at Skallary (Barra) on the 8th, and 50 and 51 at Onich and Fort William respectively on the 7th. From the 16th

to the 23rd extremely severe frosts occurred in most districts, only the islands in the west and north-west escaping. At some high level stations the frost was continuous, day and night, during that week. Braemar had 35 degrees of frost (-3°F.) on the 23rd, Glenlee (Kirkcudbrightshire) 33 degrees, and a number of other stations 32 degrees (0°F.). Ground frosts occurred every night, and in many cases were very severe. Braemar registered 40 degrees of ground frost on 17th and West Linton 39.

For Scotland as a whole it was rather a dry January, the driest since 1935. All parts, except small areas on the Firth of Tay and near Dumfries, were drier than usual, and the greater part of the country had no more than half its normal precipitation. The greatest deficiency occurred in the Western Highlands, where stations reported less than one-tenth of the normal. Snow fell heavily in many places during the last week. Undrifted snow reached a depth of a foot, trains were marooned in drifts, and country communications interrupted for several days. Drifts of 18 feet deep were reported at Dalwhinnie. There was hail here and there on 14 days between the 15th and the end of the month, but no thunder.

The month was dull along the east coast and in the Solway neighbourhood. Sunshine was also deficient in the Clyde area owing partly to fog. Fog was reported every day except the 25th, being most prevalent locally on the Clyde and Forth. Greenock had 23 foggy days and Edinburgh 11. On the other hand, the month was brighter than usual along the Caledonian Canal and in country districts of the south. Boghall (near Edinburgh) had the largest amount of sunshine—namely, 67 hours; Carluke and Forres had 61, and Eskdalemuir 57. Paisley recorded only 7 hours, and Greenock and Renfrew only 9 hours each.

FEBRUARY.

The outstanding features during February were heavy snowfall in the first few days (continuing the snowy spell of the last week of January), and severe frost between the 12th and the 19th. Weather was generally dry for the month as a whole.

An anticyclone over North-Western Europe and a depression to the south-west of the British Isles maintained the disturbed snowy south-easterly weather of late January until the 7th of February. Conditions then became rather indeterminate, tending to be mainly anticyclonic, fine, and cold, with light easterly or variable winds. From the 20th, however, Atlantic depressions brought both southerly and northerly gales with intervening fine cold spells. Gales occurred on 13 days, but none were very severe. The one which was felt most widely

was that of the 4th. Winds were strong over the whole country on this day, and mean speeds of 46 miles per hour with gusts approaching 60 miles per hour were experienced off the east coast.

February was mainly cold like December and January, and the mean temperature for the month was below normal. The Western Isles, however, were not much colder than usual; it was on the east coast and in the south-west that weather was least favourable, these areas having mean temperatures about three degrees below the average. The coldest spell lasted from the 12th to the 19th. Severe frosts were experienced at this time over most of the country. Braemar and other stations on high ground had 24 degrees of frost (8° F.) on and about the 19th, Wolfelee 22 degrees on the 16th, and Balmoral 22 degrees on the 19th. Ground frosts were general. They occurred on every night except the 26th-27th. Balmoral reported 27 degrees of frost on the ground on the 16th and 26 degrees on the 17th. Weather became milder in the last week of the month and day temperatures rose to over 50° F. at most stations. The highest reading in the screen was 58° F. at Gordon Castle on the 22nd, but 56° F. was recorded at Achnashellach, Inverness, Gordonstoun, Kilmarnock, and Kelso on the 22nd, and again at Banff, Dunbar, and Edinburgh on the 27th.

All districts in Scotland were drier than usual, and over the country as a whole it was the driest February for six years. The dryness was generally most marked in the north, but many places elsewhere also had less than half their normal precipitation. During the first five days snowfall was widespread and in places heavy, with resulting dislocation of transport as in January. There was undrifted snow to the depth of a foot in the south-west as well as in Aberdeenshire, and deep drifts occurred again locally. Further snow fell from time to time after the 5th, but the falls were not heavy. From the 19th to the 29th was a wet period, the 20th being the wettest day of the month, with over an inch of rain at many places in the west. The largest falls on this day were in Skye—2.90 inches at Broadford and 1.98 at Portree. Later in the month Kingairloch had 1.09 inch on 26th, Drimnin 1.05 on 27th, and Colonsay 1.14 on 28th. There was hail locally on fourteen days, but no thunder was reported.

February was a dull month over most of Scotland and the distribution of sunshine was rather like that of January, the east coast south of Kinnaird Head, the Clyde area, and the south-west having specially small totals. The east coast had about 30 hours less than the normal amount, the duration there being under 40 hours. Conditions in the other two dull areas were similar. The largest totals for the month were 85 hours at Forres, 84 at Nairn, and 80 at Inverness and

Fortrose, and the smallest, 31 hours at Greenock, 32 at Dunfermline, and 33 at Lundin Links. Fog was again prevalent over the Clyde and Forth areas as in January, being reported on 24 days in all.

MARCH.

March opened rather dry, but ended by being the wettest March since 1928. It was nevertheless brighter than usual at most places in the east and south. There were some severe gales in the north.

Alternating irregularly moving depressions and brief anti-cyclonic intervals gave all kinds of winter weather during the month, conditions varying from fine, bright, and cold to very unsettled with stormy winds from both northerly and southerly points. There were gales from the 3rd to the 5th, the 14th to the 18th, and the 26th to the 31st. They were frequent and severe in the extreme north. In that area the north-westerly gale of 3rd-4th lasted 19 hours and gusts reached 70 miles per hour. There was a southerly gale for 19 hours on the 17th, and a south-westerly one for 13 hours on the 31st. In the latter, strong gusts of between 60 and 70 miles per hour occurred in South-East Scotland as well as in the north.

The month was rather cool in the south-west and parts of the north, while in other districts it was somewhat milder than usual. For Scotland as a whole the mean temperature was above normal, thus ending the series of exceptionally cold months which had begun with November 1939. The mildest weather occurred round about the 18th, on which day temperatures exceeded 60 degrees in some places. The highest readings reported were 62° F. at Lossiemouth and Forres, 61 at Gordonstoun, and 60 at Fort Augustus and Achnashellach. There were three cold spells—namely, the 1st-2nd, the 6th-7th, and the 14th. These were responsible for 26 degrees of frost (6° F.) at West Linton on the 14th, 20 degrees (12° F.) at Braemar on the 1st, and 20 degrees at Wolfelee on the 14th. Ground frosts were reported on all except five nights, and were severe in many places, West Linton, for example, reporting a ground temperature as low as 0° F. on the 14th.

The first week was rather dry, but from the 7th onwards rain fell frequently in all districts, and the month overall was a wet one. At Dundee and at stations in Wigtownshire the rainfall totals reached almost double the normal. Considerable areas in the north, however, had rather less than their usual rainfall. Snow fell over the whole country during the second week, but it did not lie to any great depth. Less widespread falls which were reported daily from the 4th to the 16th and from the 19th to the 31st also did not lie.

Individual falls of rain were fairly large, though none reached 2 inches. The largest daily amounts were 1·46 inch on the 7th at Erracht, 1·79 on the 10th at Achnashellach, 1·46 on the 12th at Leslie (Fife), and 1·72 on the 19th at Forglen (Banffshire). Other wet days were the 11th, 20th, 29th, 30th, and 31st. Hail was reported on 16 days, mostly from the north, and there were thunderstorms in the east on the 19th.

Sunshine was below normal north of a line from Oban to Aberdeen and also in the neighbourhood of the Solway, but elsewhere the amounts were mainly above normal. The largest totals were 138 hours at Arbroath, 132 at Dunbar, and 131 at Carnoustie and Edinburgh—*i.e.*, about 20 hours more than usual. The smallest totals were less than 80 hours. Stornoway had 78 hours, and Braemar, with several other stations farther north, less than 80. These amounts were about 30 hours below the normal. The Clyde and Forth areas were not so outstandingly short of sunshine as in the preceding months, although fog was reported at Greenock on 13 days and at one place or another on all except four days of the month.

APRIL.

The three weeks of wet weather in March were continued by unsettled, showery, and cool conditions in the first three weeks of April. The last week of the month was warmer and mainly fair. Except in the extreme north and north-west there was marked lack of sunshine.

The series of depressions which gave the disturbed weather of March lasted until the 4th April, when it began to break. The interruption was only temporary, however, and from the 11th until the last week there was either a depression over the British Isles or one in the offing on most days. In the last week conditions were mainly anticyclonic, with lighter winds and more settled weather. Gales occurred on 14 days during the month. That on the 1st was widespread and in coastal districts severe, the wind reaching a mean speed of 55 miles per hour in places. Many stations had gusts of 70 miles per hour.

Temperatures were rather low during the early part of April, but southerly winds brought a rise of temperature about the 22nd, and thereafter the warmer weather continued. For the month as a whole the mean temperature in all parts of Scotland was not far from the normal. During the early cool period there was a specially cold spell from the 9th to the 11th. This brought to many places frosts which were severe for the time of year. On the 11th Braemar recorded 8 degrees of frost (24° F.) in the screen, and Balmoral

had 7 degrees of frost. There were ground frosts in one place or another on all except six nights of the month. From the 9th to the 11th they were widespread, and 15 to 20 degrees of frost were registered. In the warm spell of the last week, on the other hand, screen temperatures rose to 60° F. or more in all districts except the extreme north. The highest readings were 69° F. on the 28th at Achnashellach, 68 on the 26th at Dundee, and 67 on the 27th at Turnberry.

For the country as a whole the month's rainfall was close to the normal. Weather was showery until the end of the third week, and falls were frequent in all districts, though generally not heavy. There was little rain in the last week. The totals were higher than usual in the north and the greater part of East Scotland, while in the west and centre they were below normal. Daily falls exceeding an inch occurred in the north and west on five days during the first half of the month. Glenshiel (Ross) had an inch or more on 1st, 3rd, 7th, 14th, and 15th (2·1 on the 15th), and a total of 10·23 inches. The only fall exceeding an inch in the latter half of the month was 1·07 on the 27th at Ettrick (Selkirkshire). Snow fell here and there during the periods 1st-7th, 14th-17th, 20th-21st. On the 15th there was snow in all districts, but it did not lie to any great depth. Hail was reported on fifteen days and was accompanied by thunder on several days. Falls were widespread on the 3rd in the southern parts and occurred all over the country on the 15th.

April was a dull month almost everywhere. The most favoured areas were the Shetlands and the Outer Hebrides, where the sunshine totals were only a little below normal. Many places in the west and south-west had from 40 to 50 hours less sunshine than usual. In the favoured area there were some bright periods giving over twelve hours' sunshine on various days in the latter half of the month. The largest quotable total was 144 hours at Strathy while the smallest was 77 at Benmore, near Dunoon. Other small totals (not including places where there is cut-off by neighbouring hills) were 81 at Glasgow and 89 at Cardross. Fog was reported on twelve days, and was most prevalent along the east coast during the last week.

MAY.

The fair and warmer weather which set in after the wet period of April continued throughout May. The month was a sunny one in most parts, especially so in the extreme north and along the east coast. For Scotland as a whole it was the warmest May since 1911.

Weak anticyclonic gradients of pressure with lighter winds and more favourable weather prevailed, though no anticyclone was definitely centred over the country. There were a few breaks in these conditions, but even then Scotland was mainly in the outskirts of the depressions. The only gale reported during the month occurred in the extreme north during the night of the 9th-10th. It was a short-lived one associated with a depression far to the north.

The month was an equable one. Temperatures were nowhere very high, but the means for the month were well above normal in all districts. Most places were free from frost so far as screen temperatures were concerned, but slight ground frosts were reported locally on eighteen nights. Shade temperatures reached 70° F. or more on several days, the highest readings reported being 76° F. on the 20th at Kilmarnock, 75 on the 18th at Nairn, and 75 on the 19th at Gordon Castle and Forres. Braemar, Balmoral, Logie Coldstone, and West Linton had slight frosts (30° F.) during the third week, and in this period also West Linton reported a ground temperature of 20° F. on the 20th, and Braemar had 22° F. and 24° F. on the 19th and the 22nd respectively.

Weather was dry almost everywhere, and only in small areas near Arisaig and Poltalloch did rainfall totals just exceed the normal. However, though the rainfall was light, the falls were distributed over the whole month, very few stations having a week without rain. Relatively speaking, Greenock was the driest station in the country, as its total of 0·82 inch was only 26 per cent of the normal. Only two daily falls reached one inch, both on the 15th, when Little Barraer near Newton Stewart registered 1·03 inch and Borgue (Kirkcudbright) 1·01. Hail was reported on six days, and Ben Nevis had a covering of either snow or hail on the 15th. There were widespread thunderstorms in the south from the 24th to the 29th, but they were not specially severe. Thunder occurred here and there also on the 9th, 15th, 17th, 23rd, and 30th.

Sunshine was specially abundant in Shetland, Orkney, and along the east coast, and only along the Caledonian Canal and to the west of it were the totals somewhat low. In many places the total for the month exceeded the normal by over 40 hours, and some daily amounts were large. Lerwick recorded a total of 217 hours (60 hours more than the normal). Other large totals were 221 hours at St Andrews and Arbroath, 217 at Carnoustie, and 214 at Leuchars. The smallest totals were well over 100 hours—namely, 130 at Fort Augustus and 150 at Onich.

JUNE.

The fine weather which started in the third week of April persisted through May, and culminated in a most exceptionally bright, dry, and warm June. Many meteorological records were broken. It was the warmest June for over eighty years, the driest since 1925, and in some places the sunniest since 1884.

An extension of the permanent Azores anticyclone controlled the British Isles during the greater part of the month, and depressions passed by to the north. These anticyclonic conditions were interrupted by near-by depressions from the 22nd to the 28th, without, however, any great effect on the weather of Scotland. Gales were reported off the west and north coasts on six days, but none were severe.

Mean temperature for the whole country was well above normal; in fact, it was the warmest June for over eighty years, the last year which approached the same level being 1858. The hottest spell was from the 4th to the 9th, screen temperatures then rising to 80° F. or more. Perth had 89° F. on the 6th, a June temperature previously equalled only in 1859 and 1887. It was the highest temperature at any Scottish station in any month since July 1911, when the reading reached 90 degrees at Perth. Other high temperatures were 87 on the 6th and 9th at Kilmarnock and Auchincruive respectively, and 86 on the 5th and 6th at Ruthwell. The 19th was also exceptionally warm, 80 degrees or more being reported in many places. The night temperatures in most districts were never below 40 degrees, but the 17th was cold on the high ground of Central Scotland, Balmoral and Braemar reporting screen temperatures of 31 and 32° F. respectively on this night. There were ground frosts on five nights during the month. Apart from that of the 17th, when Braemar recorded 25° F. and Balmoral 26° F. on the ground, these frosts were slight.

Very little rain fell during the first twenty days of June, and some places in the south and east had fifteen or more consecutive days without measurable rain. The last ten days were showery, but the falls were only light. At several stations in the east the total rainfall for the month was less than 0.25 inch, or only about one-tenth of the normal. One or two localities in the north did, however, receive slightly more than the normal rainfall as a result of heavy thunderstorms. The largest amounts recorded in one day were 1.83 inch and 1.81 on the 8th near Galashiels at Clovenfords and Fairnilee respectively, 1.20 on the 10th at Fyvie Castle, 1.15 on the 15th at Forglen (Banff), and 1.13 on the 22nd at Glasgow. Thunderstorms were reported daily from the

3rd to the 12th and on the 15th, 21st, 22nd, and 28th. They were widespread from the 7th to the 10th and on the 22nd, and round Galashiels on the 8th a storm lasted on and off for seven hours. Hail fell locally on the 26th and 27th, a report of sleet came from Troon on the 25th, and there was a thin cover of white over Ben Nevis on the 26th.

The month was remarkably sunny in all parts of the country. Sunshine averaged as much as 10 hours a day at several stations, and in places the monthly totals were more than 100 hours above normal.

The largest totals were 304 hours at Arbroath, 301 at Marchmont, 292 at Carnoustie, and 264 at Paisley. This record at Paisley was the highest since the Observatory was started in 1884. Sea fog was reported on twelve days during the month. It was frequent along the coasts, especially in the east, during the hot spell.

JULY.

The fine weather of May and June was broken in July, which was an extremely wet month. It was the wettest July since 1884. Sunshine was correspondingly deficient, and temperatures low.

The Azores anticyclone which had controlled the weather of June withdrew from Scotland at the end of June and thereafter a series of depressions, wet though not intense, passed over and near the British Isles. This series lasted until the 26th, after which the Azores anticyclone extended north-eastwards again. Gales occurred in the west and north on the 9th, 11th, 13th, and 14th, but none were severe.

The mean temperatures for the month were below normal again after the series of relatively warm months lasting from March inclusive. For the country as a whole the mean was rather more than a degree lower than usual. Day temperatures were specially low from the 13th to the 18th. On some of these days the maximum temperature reached only 53° F. at Inverness, Gordon Castle, Balmoral, and stations on the east coast. The coldest nights occurred from the 23rd to the 28th, when temperature fell to 40 degrees at many places. The 22nd-23rd was specially cold, West Linton, Glenlee, and Benmore recording 36 degrees. There were slight ground frosts at high-level stations on the 7th, 10th, and 28th, also at Auchincruive and Glenlee on the 23rd and at Onich on the 28th. The highest temperatures occurred on the 31st, Perth then reporting 80° F., and Dundee, Kettins, Stirling, and Kelso 78. The nights were also warm at this time, the night minima being as high as 58 degrees at Gordon Castle, Craibstone, and Prestwick.

Except in Shetland and a small area north of the Clyde the rainfall totals were far above the average. In some places there was rain every day and at others the only rainless days were the 15th and the 31st. In the east more than double the normal amount fell generally, and some stations round the Firths of Forth and Moray had over three times the normal. In several cases the July rainfall exceeded the total for the preceding six months, and the Edinburgh total was greater than in any month of the year since 1896. Glenferness (Nairn) had 11·01 during the month, and Cawdor, Drynachan Lodge, and Achfary (Loch More) over 9·5 inches. Daily falls exceeding an inch were numerous in all parts from the 10th to the 20th. The wettest days were the 10th and the 17th, when several stations had over 2 inches. The heaviest falls on the 10th were 2·16 at Cullen House and 2·06 in Edinburgh (Botanic Gardens), and on the 17th, 2·40 inches at Dirleton and 2·18 at North Berwick. Thunderstorms were frequent and widespread, especially in the second and third weeks, and there was a "cloudburst" at Cromarty on the 26th which did much damage. Hail accompanied the thundery conditions on five days of the month.

As might be expected, there was a marked and general shortage of sunshine. Nevertheless in the small area north of Clyde, which had a slight deficiency of rainfall, there was also slightly more sunshine than the average. The deficiency of sunshine was most marked in East Scotland, where many stations had 50 hours less than usual. The largest totals for the month were 171 hours at Tiree, 165 at Rothesay, and 163 at Dunoon, Troon, and Kilmarnock. Many places had less than 100 hours, and specially small totals were 85 hours at Craibstone, 86 at Forres, and 87 at Gordon Castle. There was fog locally on eleven days between the 2nd and the 19th.

AUGUST.

There was a reversion to very dry conditions in the east and south of the country during August, but wet weather persisted in some areas of the west and north-west. Temperature and sunshine showed no very outstanding features.

There was an anticyclone over or off Western Europe practically throughout the month, but parts of Scotland were just inside the depression belt and had correspondingly unsettled weather. Gales were reported on twelve days between the 10th and the 28th, and though none were of great severity gusts up to about 65 miles per hour occurred at places in the north-west on the 10th and the 21st.

There was a considerable range of temperature, but the

mean for the month was about normal in most districts. The warmest weather had already started on 31st July, and lasted during the first week of August. At this time screen temperatures rose to 80° F. in many places. The highest readings were 83° F. at Perth and 82 at Strathly, both on the 3rd, 81 at Kilmarnock on the 2nd, and 81 at Inverness, Gordon Castle, and Wolfelee on the 3rd. There was a cool spell from the 24th to the 28th, when night minima of 40 degrees occurred generally. At this time Wolfelee had 32° F. on the 24th, and Strathly 33 on the 28th. Light ground frosts were reported locally on the 24th, 27th, and 28th.

For the greater part of the country August was a dry month. The shortage of rainfall was most marked in the south and east, where some places had barely a quarter of their normal amount. Over the Western Highlands and Shetland, on the other hand, rainfall was in excess, the excess being large in some localities. In the dry area Edinburgh had only nine days with rainfall and the total was only 0·74 inch. This may be contrasted with Loch More (Sutherland), which had 12·62 inches, or over twice the normal amount. At this station there was rain on twenty-seven days, four of which had more than an inch. Daily falls exceeding an inch were fairly numerous in the west, and included two falls exceeding 2 inches—namely, 2·47 at Achfary on the 24th and 2·03 at Ardtornish on the 19th. There were very few thunderstorms, and no hail was reported. The only reports of thunder were from Bonskeid (Perthshire) on the 6th and Dundee on the 13th.

In most parts the duration of sunshine was about normal, but the south and east were brighter than the west and north, corresponding with the amounts of rainfall. By far the largest total recorded was that of Carnoustie, which had 191 hours, or 40 hours more than the normal. Other good totals were 170 hours at Kilmarnock, 169 in Edinburgh, and 168 at St Andrews and Arbroath. Among the smallest totals were 97 at Fort Augustus, 102 at Duntuilin (Skye), and 106 at Lerwick. There was fog, mostly coast fog, on thirteen days. It was reported over a wide area on the 3rd.

SEPTEMBER.

September was on the whole cool and there were considerable variations of rainfall and sunshine from place to place. The north-east was relatively dry, and the centre, west, and north relatively dull.

The country continued to lie mainly on the outskirts of an anticyclone which, as in August, was situated over and off Western Europe. From time to time, however, it was within

the northern depression belt. Gales were reported on fifteen days. The most severe one occurred on the 6th and 7th, when there were gusts of 50 to 60 miles per hour on the east and west coasts and over 60 miles per hour in the north.

The mean temperature was rather below normal in all districts, the deficiency reaching 2 degrees at widely separated stations. As in August, the first week was the warmest. Screen temperatures then reached 70° F. in many places. The highest readings were 75 degrees at North Berwick and Liberton (Edinburgh), and 74 at Kelso, all on the 4th. There were cold spells from the 9th to the 11th, on the 15th and 16th, and a more marked one on the 29th and 30th. At West Linton on the 29th there were 8 degrees of frost (24° F.), and at Balmoral (16th and 30th), Glenlee (29th), and Logie Coldstone (30th) 5 degrees of frost. Ground frosts were fairly frequent at inland stations after the 8th; West Linton had 19° F. on the 29th, Auchincruive 20° F. on the 25th, and Troon and Balmoral 20° F. on the 29th.

Rain fell frequently everywhere except in the north-east and central areas. At some places there was a considerable deficiency; Inverness and Balmoral, for example, had only about half the normal. On the other hand, places such as Loch More (Sutherland) and Stobo Castle (Peebles) had nearly double the normal. The wettest day was the 16th. On this day many stations recorded more than an inch of rain, several places in the south-west over 2 inches, and three stations in Ayrshire (Maybole, Culzean Castle, and Muirkirk) over 3 inches. Thunder occurred on seven days and was widespread on the 19th. The thundery conditions were accompanied by hail on six days.

The weather was sunny in the south and east, but relatively dull in the centre, west, and north. As in August, Carnoustie recorded the largest total—namely, 174 hours, or 41 hours above the normal. Other large totals were 170 hours in Edinburgh and St Andrews, and 168 at Kirkcaldy. Along the Caledonian Canal and in Shetland the totals were about 30 hours below normal. The smallest amounts were 67 hours at Fort William and 73 at Fort Augustus and Lerwick.

OCTOBER.

The month was wet and sunshine deficient almost everywhere; nevertheless it was warmer than usual. There were some severe gales.

The Azores anticyclone controlled the weather of the first three days and weather was correspondingly fine. Then a series of depressions moved eastwards across or near the

country until the 17th, when there was a brief spell of irregular pressure distribution followed by more depressions until the 23rd. An anticyclone, first centred near Iceland but subsequently transferred to North-West Europe, was then in the ascendant until the 29th, when a depression approached across the Atlantic. There were gales on twelve days. They were widespread on the 9th, 10th, and 29th to 31st. Unusually severe conditions prevailed on the 29th and 30th, mean wind speeds exceeding 50 miles per hour off all coasts. Gusts of over 70 miles per hour were recorded in several places.

The mean temperature was rather above the average in most places, the greatest excess being reported from Shetland. There were specially warm periods from the 1st to the 3rd and the 13th to the 16th. During these periods readings of 60 degrees or more were reported in many places. The highest temperatures were 64 degrees at Perth and 63 at Forres on the 1st. Weather was cold on the 12th and during the last week. Kelso had a night minimum of 23° F. on the 12th, and Kilmarnock and Glenlee 25° F. on the 27th. Ground frosts were frequent and widespread. They occurred on twenty days, with readings of 16° F. and 18° F. at Glenlee and Auchincruive respectively on the 27th, and 19° F. at Onich on the 26th.

The rainfall totals were well above the normal in most parts. Some places in Western Argyll had nearly twice the normal amount. On the other hand, there was an appreciable shortage in the extreme north and shortages also in the north-west and the south-east. The largest totals were 13·97 inches at Kingairloch and 13·82 at Arrochar. Daily falls exceeding an inch were unusually numerous, and on the wettest day (the 30th) many stations in the west had more than 2 inches, while the two stations Ardtornish and Kingairloch registered over 3 inches. Snow was reported down to 1700 feet in the Grampians on the 9th and on Ben Wyvis from the 24th to the 28th. There were thunderstorms in all districts on the 9th, and local storms on six other days. Hail accompanied the thundery weather on several days.

Sunshine totals were below the average everywhere except Orkney, where there was a very slight excess. At some stations on the east coast and in the belt from the Forth to the Clyde there was only about half the normal amount. At many stations it was the dullest October experienced since records were started. The largest totals were 88 hours at Nairn, 84 at Fortrose, and 83 at Kirkwall and Carnoustie. Along the Ayrshire coast totals were only about 40 hours, while in the Clyde area Greenock had only 27 hours and Glasgow and Cardross only 25 each. Fog was reported on twenty-three days. Greenock had fog on eleven days and Edinburgh on nine days.

NOVEMBER.

Like October, this month was dull with persistent rain and a general lack of sunshine, but the weather was again relatively mild.

There were but brief interruptions in the series of depressions which passed over and near the country during November, and weather was unsettled almost throughout. Gales were reported on nineteen days. They were widespread between the 20th and the 26th and in some cases severe. Mean wind speeds approaching 50 miles per hour were registered off both the east and the west coasts, and gusts reached 70 miles per hour on the 21st and the 25th.

In most parts of the country the mean temperature was high for the time of year, the excess over normal amounting to 2 degrees at some stations in the west and south-west. In the extreme north conditions were about normal. The mildest spells were on the 1st and 2nd and from the 24th to the 27th. At these times screen temperatures exceeded 50° F. generally. The highest reading—namely, 58° F., was reported from Colmonell and Newton Stewart on the 2nd, Logie Coldstone on the 24th, Lossiemouth on the 25th, and Gordon Castle and Banff on the 26th. There were cold spells on the 4th-5th and in the middle of the month. Braemar had 19° F. (13 degrees of frost) on the 5th, 15th and 16th, and Logie Coldstone and Balmoral 21° F. on the 5th. Ground frost was reported on all except four days. It was severe in some cases; for example, at Glenlee the ground temperature fell to 14° F. on the 15th.

Rainfall was above the average generally. It was very persistent, many places having rain on 26, 27, or 28 days. The wettest area was the north-east, where the month's totals were more than twice the average. Aberdeen had its wettest November since 1872, with a total of 7·24 inches against the previous highest total of 6·47. Kinlochquoich and Loan had 22·03 and 23·85 inches respectively. Daily falls exceeding an inch occurred in all parts and on 23 days of the month. The wettest day was the 25th, when many western stations recorded over 3 inches. The largest amounts on this day were 4·20 at Kinlochquoich and 3·75 at Broadford (Skye). Snow was reported on 16 days, mostly in the hills. Hail fell on 16 days and was widespread on the 27th. It was accompanied by thunder at times. Thunderstorms were numerous on the 23rd, and occurred locally on 9 other days.

In general, the duration of sunshine was well below normal. Leuchars had its dullest November since recording was started, and only Lerwick, Stirling, and Marchmont reached their normal amounts. The largest totals were 56 hours at

Marchmont and Dunbar, 53 at Stonehaven, and 52 at Edinburgh and Lossiemouth. Many places had under 30 hours, the smallest totals being 17 at Oban and 21 at Fort William and Glasgow. There was fog on 12 days, mostly in the Clyde area.

DECEMBER.

December had no very outstanding features. It was rather cool in places and some areas had rather more rain and less sunshine than usual, while others had less rain and more sunshine.

For the first few days of the month the country lay between a continental anticyclone and a depression belt to the north, so that except in the extreme north weather was fair. Subsequently until the 16th it was disturbed by a succession of Atlantic depressions, with short intervals between. On the 17th, however, a continental anticyclone extended over the British Isles, and although drifting about rather irregularly this continued to control conditions until the 28th, when a fresh Atlantic depression arrived. Wind reached gale force in a few places on the 1st, the 4th to the 9th, and the 13th to the 18th. Mean speeds approaching 50 miles per hour were recorded on the 13th, 15th, and 18th, while gusts of about 70 miles per hour occurred on the 5th, 15th, and 18th.

The mean temperature was between one and two degrees below normal in the south-west and round the Moray Firth; elsewhere there was no noteworthy departure from the normal. The mildest spell was in the middle of the month, but the beginning of the month was also mild. During these spells the night minimum was generally between 40 and 45° F., but Skallary and Perth reported readings of 49. Day temperatures exceeded 55° F. at many places; Fort William, Greenock, and Gordon Castle reported 57° F., and several other stations 56. Weather was coldest towards the end of the month, and most stations had their coldest day on the 31st. Braemar had 16 degrees of frost (16° F.) and Achnashellach 12 degrees of frost at this time. There was also a cold spell about the 20th, when Fort Augustus registered 21° F. and Kilmarnock and Inverness 24. Ground frosts occurred on all but two days, and ground temperatures of 14° F. were reported at Nairn on the 21st and at Braemar and Balmoral on the 31st.

Rainfall was below the average in the east and in the extreme north, while parts of the west, south-west, and places in the Caledonian Canal area had more rain than usual. The deficit locally round the mouth of the Tay and at some stations in the north was from 40 to 50 per cent, and the excess at some stations in Argyllshire and Ayrshire, also about 50 per cent. There were wet periods from the 1st to about the 8th, the

13th to the 18th and the 28th to the 31st, while relatively dry periods were the 11th-12th and the 19th to the 23rd. The wettest days on the whole were the 5th and the 6th, when Forrest Lodge (Dalry) had 2·01 inches and a number of scattered stations over 1 inch. The largest daily fall was 3·50 inches at Glendessary on the 16th. Monthly totals ranged from 1·17 inch at Dirlerton, 1·25 at North Berwick, and 1·42 at Forres to 21·5 at Loan, 13·89 at Glenbranter, and 11·29 at Achnashellach.

Sunshine was rather deficient in the east, but most places in the west and north had more than their normal amount. The largest totals were reported from the south-west, where Turnberry had 47 hours, Dumfries 45, Kilmarnock 43, and other stations similar amounts. Small totals were 8 hours at Fort William, 9 at Oban, 11 at Glasgow and Braemar, 13 at Lerwick, and 17 at Banff and North Berwick.

GENERAL NOTES.

The year was characterised by extremes and spells of sharply contrasted weather; nevertheless over the greater part of the country the mean temperature, the total rainfall, and the duration of sunshine did not differ greatly from the normal. Outstanding features were the very cold January (the coldest for 45 years), a June which broke all records in sunshine, and an excessively dull and wet July. There was very heavy snowfall in late January and early February, very frequent thunder in July and almost none in August, much rain in the last quarter, and unusually frequent though not exceptionally severe gales.

RAINFALL (MEASURED IN INCHES) FOR 1940

AT SELECTED STATIONS IN SCOTLAND.

	Jan	Feb.	Mar.	April	May	June	July	Aug	Sept.	Oct.	Nov	Dec	Year.
Shetland—Lerwick	1.57	2.21	4.96	4.40	1.65	1.13	1.65	3.99	4.73	2.49	5.50	3.69	37.97
Orkney—Kirkwall	1.80	1.18	3.41	2.09	1.50	1.32	4.44	4.85	4.17	3.26	5.09	3.77	36.88
Caithness—Wick	1.43	.71	1.78	2.92	1.74	1.00	4.51	2.53	2.27	2.26	3.91	1.95	27.01
Sutherland—Strathay	2.05	1.50	3.92	3.48	1.62	2.33	8.23	2.70	3.63	2.94	5.04	3.02	41.06
Lairg	1.41	1.14	2.15	3.58	1.14	1.95	6.93	2.75	2.98	4.01	6.73	3.28	38.05
Ross and Cromarty—													
Fortrose	.80	1.18	2.01	1.94	1.38	.79	8.83	1.05	1.84	3.02	4.55	3.31	30.20
Tain	.96	1.20	1.85	3.71	1.93	1.04	9.17	1.19	1.74	3.77	5.27	3.48	35.31
Lochcarron	.83	4.10	4.35	4.63	2.27	3.27	8.45	7.83	8.22	7.13	8.85	10.61	70.54
Stornoway	2.53	1.91	2.22	3.88	1.67	1.63	4.71	3.21	3.64	4.40	5.74	4.66	40.22
Inverness—													
Inverness	.76	1.48	1.70	1.74	1.58	.54	8.28	1.14	1.31	3.34	4.26	2.77	28.96
Fort-William	1.12	3.79	6.44	3.89	2.13	2.12	6.92	5.38	5.60	6.92	9.93	12.15	65.29
Glenquich	.62	3.90	8.39	6.10	3.80	3.41	8.67	11.45	9.44	11.85	18.64	15.56	101.33
Portree	1.28	4.85	4.47	3.49	2.71	2.88	5.42	7.35	6.87	7.64	11.57	5.33	63.86
Nairn—Nairn	.86	.63	2.30	1.47	1.37	.46	7.75	1.17	1.36	3.05	3.65	2.42	26.49
Moray—Gordon Castle	1.00	.90	3.44	1.80	1.73	1.79	7.77	1.77	2.30	2.39	6.63	2.84	34.36
Aberlour (Wester Elchies)	.97	.96	3.19	1.81	1.92	1.32	8.34	2.58	2.02	2.46	6.23	3.37	35.47
Banff—Banff	1.69	1.32	3.42	1.25	1.67	1.45	6.30	1.89	3.08	1.90	5.16	2.88	32.01
Aberdeen—Peterhead	1.33	1.40	1.88	2.34	1.64	.53	6.13	2.14	2.88	2.67	6.60	3.48	33.02
Aberdeen (King's Coll.)	1.50	1.70	2.35	2.30	1.50	.58	7.69	1.76	2.30	3.22	7.24	2.86	35.02
Balmoral	1.31	1.20	2.26	1.62	1.11	.36	6.42	1.78	1.13	4.32	5.68	2.53	29.72
Kincardine—Fordoun	1.71	2.30	2.68	1.75	1.25	.48	7.37	1.45	2.25	4.78	6.21	2.97	35.40
Angus—													
Montrose (Asylum)	1.49	1.49	2.70	1.21	1.32	.23	5.58	.73	1.97	4.65	5.91	1.75	28.95
Dundee	1.95	1.18	2.85	1.16	1.59	.46	5.81	1.11	2.12	4.53	4.98	1.13	28.87
Glamis Castle	2.14	1.75	3.80	2.10	1.16	.38	4.79	1.09	1.90	4.29	5.97	1.32	30.49
Brechin	1.97	1.90	2.97	1.75	4.33	.15	5.97	1.05	1.96	5.41	6.44	1.96	35.86
Perth—Blair Castle	1.41	1.58	2.68	2.16	1.37	.54	3.57	1.37	1.54	4.94	5.12	3.77	30.05
Crieff	1.70	2.40	4.00	2.68	1.62	.26	5.31	1.06	2.15	5.19	6.16	4.20	36.73
Perth	1.53	1.87	2.86	2.13	1.04	.39	6.15	.94	2.13	4.05	4.68	2.19	29.86
File—Cupar	2.36	1.24	3.06	1.74	1.59	.55	6.78	1.00	2.24	3.75	4.86	1.95	31.12
Kirkcaldy	.80	.78	2.81	2.51	1.37	.78	6.27	.81	2.39	4.10	3.86	1.84	28.31
Kinross—Loch Leven	1.73	1.25	3.22	2.90	.83	.71	5.56	.78	2.21	4.26	5.16	2.87	31.53
Clackmannan—													
Tillicoultry	1.64	1.48	3.23	2.96	1.71	.57	4.07	1.30	3.05	4.27	5.09	3.03	32.40
Argyll—Gruline (Mull)	2.45	4.77	7.38	3.56	2.77	2.36	6.22	6.05	8.13	12.85	11.38	12.35	80.27
Oban	1.08	2.68	4.08	2.20	2.24	1.25	4.97	4.08	4.53	8.01	7.98	7.25	50.35
Glencoe Gardens	1.02	3.66	7.50	4.75	2.31	2.21	5.84	3.79	5.46	11.37	11.06	12.61	71.56
Inveraray	2.03	4.18	5.84	3.76	1.72	1.99	4.54	4.81	7.19	8.62	11.39	10.94	67.01
Bute—Rothesay	2.71	1.84	5.13	2.55	1.82	1.03	4.90	2.96	4.07	7.67	8.60	7.54	51.72
Stirling—Stirling	1.97	1.30	3.20	3.02	1.19	.83	4.67	.94	2.20	4.94	5.06	3.55	32.87
Dumbarton—Arrochar	2.35	4.22	7.83	4.71	1.77	1.73	4.11	5.67	7.12	12.32	12.50	12.26	78.09
Helensburgh	3.90	3.08	4.69	3.31	1.05	.72	3.79	2.66	3.72	6.80	7.10	6.73	47.55
Renfrew—Greenock	3.50	2.50	5.26	3.26	.85	1.28	3.06	2.77	4.99	7.78	8.72	7.94	51.91
Paisley	3.07	1.65	4.56	2.23	.72	.63	3.66	1.94	3.58	5.84	6.20	5.07	39.15
Ayr—Kilmarnock	2.67	1.44	4.59	1.94	.82	.58	3.75	2.89	5.01	4.27	5.00	6.13	39.39
Ayr	2.50	1.10	4.22	1.87	1.25	1.25	3.63	1.82	5.66	3.09	4.22	4.18	34.79
Muirkirk	2.67	1.35	6.04	2.68	1.27	.98	5.50	2.97	7.20	5.01	6.18	7.98	49.92
Ballantrae	1.10	1.75	5.01	1.56	1.82	1.33	3.77	1.88	4.74	4.44	5.47	5.55	41.45
Lanark—													
Glasgow (Botanic Gdns.)	2.63	1.52	4.37	2.55	1.08	.75	3.97	2.08	3.47	4.94	4.66	4.28	36.30
Leamnahagow	2.06	1.20	3.87	2.91	.92	.84	4.88	1.82	4.42	4.22	4.72	4.77	36.03
Biggar	1.47	.75	3.63	2.48	3.10	.60	5.86	1.62	4.98	3.51	3.83	4.18	36.10
Linlithgow—													
Houston House	1.79	1.04	3.03	2.53	2.12	.46	6.56	1.22	2.81	3.31	4.22	3.21	32.30
Midlothian—													
Edinburgh (University)	1.03	.86	2.48	2.04	1.96	.52	8.07	.72	2.37	2.33	3.78	1.82	27.98
Gorebridge	.91	1.24	3.00	1.88	2.48	.45	7.80	.74	3.08	2.56	4.21	1.67	30.11
Oxenford Castle	1.06	1.21	2.61	1.83	1.73	.52	8.32	.52	2.81	2.70	4.04	2.29	29.94
Haddington—													
North Berwick	1.45	.82	2.62	1.84	1.57	.45	8.42	.80	2.30	2.96	3.29	1.37	27.98
Stobshiels Reservoir	.96	1.59	2.70	2.30	1.89	.19	9.32	.95	2.72	3.47	4.97	2.47	33.85
Perth—Duns Castle	1.79	1.73	3.16	1.94	1.14	.55	7.51	.74	1.81	3.85	4.24	2.67	31.13
Marchmont	1.67	1.55	3.43	1.85	1.23	.65	7.34	.88	2.21	3.71	3.97	2.30	30.79
Peebles—West Linton	1.64	1.21	3.95	2.96	4.04	1.05	5.52	1.82	4.38	3.24	4.42	4.01	38.24
Seikirk—Whitmuir Hall	1.77	1.20	3.28	2.19	1.96	.97	6.29	.98	2.76	3.16	3.60	3.33	31.65
Roxburgh—													
Kelso (Broomlands)	.94	1.11	2.76	1.45	1.45	1.12	7.06	1.04	2.66	2.66	3.05	2.31	27.61
Wolfelee	1.43	1.25	4.32	1.50	2.45	.67	7.47	.83	3.80	3.08	3.97	3.59	33.56
Dumfries—Dumfries	3.41	1.32	4.33	2.40	1.37	1.11	6.18	.77	3.27	4.54	4.90	4.32	37.92
Monsalvo	3.72	2.59	6.03	2.62	1.68	.74	5.34	1.66	5.06	6.17	7.02	8.89	51.52
Langholm	1.76	2.30	6.20	3.35	3.36	1.18	6.25	2.90	4.62	4.40	6.09	6.24	48.65
Eskdalemuir	3.37	2.83	6.49	3.85	1.47	1.54	6.67	2.80	5.31	5.06	7.07	7.38	54.74
Kirkcudbright—Castle Douglas (Corbotten)	2.86	1.41	5.36	2.28	1.28	.76	4.48	.80	3.79	4.71	5.09	4.20	37.09
Carphairn (Shiel)	2.48	2.51	7.10	3.83	1.60	.92	5.69	2.39	6.35	6.52	11.07	11.65	62.11
Auchencrain	4.08	1.33	4.99	2.69	.77	1.18	4.62	1.05	3.40	4.96	5.67	6.28	40.92
Wigtown—Monreith	5.11	2.44	5.11	2.46	1.49	.71	4.29	1.11	3.40	4.97	7.08	5.06	43.23

AGRICULTURAL STATISTICS.

NOTE.—Owing to war-time restrictions, details under the following Tables, Nos. 1-8, will not be available until after the termination of the War.

TABLE NO. 1.—ACREAGE UNDER CROPS AND GRASS IN EACH COUNTY OF SCOTLAND, RETURNABLE ANNUALLY ON 4TH JUNE.

TABLE NO. 2.—TOTAL ANNUAL PRODUCE OF WHEAT AND BARLEY, ACREAGE AND YIELD PER ACRE IN EACH COUNTY OF SCOTLAND.

TABLE NO. 3.—TOTAL ANNUAL PRODUCE OF OATS, ACREAGE AND YIELD PER ACRE IN EACH COUNTY OF SCOTLAND.

TABLE NO. 4.—TOTAL ANNUAL PRODUCE OF POTATOES, ACREAGE AND YIELD PER ACRE IN EACH COUNTY OF SCOTLAND.

TABLE NO. 5.—TOTAL ANNUAL PRODUCE OF TURNIPS, SWEDES, AND MANGOLDS, ACREAGE AND YIELD PER ACRE IN EACH COUNTY OF SCOTLAND.

TABLE NO. 6.—TOTAL ANNUAL PRODUCE OF HAY FROM RYEGRASS AND OTHER ROTATION GRASSES AND CLOVER, ALSO TOTAL FROM PERMANENT GRASS, ACREAGE AND YIELD PER ACRE IN EACH COUNTY OF SCOTLAND.

TABLE NO. 7.—HAY FROM TIMOTHY MEADOWS: TOTAL ANNUAL PRODUCE, ACREAGE AND YIELD PER ACRE IN EACH COUNTY OF SCOTLAND.

TABLE NO. 8.—NUMBER OF HORSES, CATTLE, SHEEP, AND PIGS IN EACH COUNTY OF SCOTLAND, RETURNABLE ANNUALLY ON 4TH JUNE.

TABLE NO. 9.—QUANTITY AND VALUE OF CORN, &c., imported into the United Kingdom in the undermentioned Years.

[From Trade and Navigation Returns.]

	Quantities.			Values.		
	1938.	1939.	1940.	1938.	1939.	1940.
				£	£	£
Wheat from —	Cwt.	Cwt.	Cwt.			
British India . . .	4,397,217			1,606,188		
Australia . . .	31,005,730			11,936,041		
Canada . . .	28,853,871			11,212,121		
Other British Coun- tries . . .	17			21		
Soviet Union . . .	9,587,670			3,055,370		
Germany . . .	261			253		
France . . .	1,235,815			267,633		
Roumania . . .	3,606,515			735,101		
United States of America . . .	15,789,880			6,740,275		
Argentine Republic .	5,810,656			2,507,488		
Other Foreign Coun- tries . . .	1,412,421			557,716		
Total . . .	101,649,553			38,618,152		
Wheat products—						
Meal and flour from			do.			dr.
Australia . . .	2,430,994			1,420,386		
Canada . . .	3,653,485			2,090,739		
Other British Coun- tries . . .	5,619			2,199		
France . . .	180,294			52,785		
Italy . . .	..				
United States of America . . .	94,984			225,055		
Argentine Republic .	889,314			142,973		
Other Foreign Coun- tries . . .	122,995		Do.	46,407		Do.
Total . . .	7,677,595			3,980,544		
Barley . . .	19,862,277			6,861,099		
Oats . . .	1,572,797			536,725		
Pears, not fresh . .	1,944,733			1,140,684		
Beans, not fresh . .	956,176			502,186		
Maize . . .	57,628,180			17,709,955		
Maize products . . .	3,850,103			1,627,572		
Oat products . . .	594,610			773,380		
Rice . . .	2,677,091			1,186,545		
Other kinds of grain .	421,605			171,261		
Other products . . .	549,740			815,049		
Farinaceous substances not elsewhere speci- fied and Malt . . .	824,788			508,287		
Total of corn, &c. .	90,887,100			31,835,743		
Total of Group . .	200,214,548	..	.	74,434,489	55,446,208	93,859,241

Detailed figures not available at date of publication.

Detailed figures not available at date of publication.

TABLE NO. 10.—SUMMARY OF TOTAL VALUES APPEARING IN TABLE NO. 9 OF GRAIN AND FLOUR imported into the United Kingdom for the years 1938, 1939 and 1940.

	1938.	1939.	1940.
From—	£	£	£
Union of South Africa	1,540,816	<i>Detailed figures not available at date of publication.</i>	do.
Southern Rhodesia	209,503		
Kenya	194,826		
British India	2,505,688		
British Malaya	194,088		
Australia	14,398,155		
Canada	18,573,347		
Other British Countries	234,058		
Soviet Union	4,187,412		
Denmark	432,050		
Poland	97,261		
Germany	17,400		
Netherlands	1,466,862		
Java	146,676		
Belgium	1,353,793		Do.
France	395,434		
Madagascar	114,557		
Spain	3		
Italy	18,606		
Bulgaria	130,746		
Roumania	1,312,731		
Iraq	995,361		
Iran	12,752		
Japan	224,521		
United States of America	15,624,074		
Chile	153,585		
Argentine Republic	8,195,614		
Other Foreign Countries	1,578,519		
Total	74,434,439	55,446,205	93,859,241

TABLE NO. 11.—SUMMARY OF TOTAL VALUES APPEARING IN TABLE NO. 16 OF DAIRY PRODUCE imported into the United Kingdom for the years 1938, 1939 and 1940.

	1938.	1939.	1940.
From—	£	£	£
Elre	3,326,476	<i>Detailed figures not available at date of publication.</i>	do.
Union of South Africa	376,867		
Australia	11,116,092		
New Zealand	20,330,566		
Canada	3,008,634		
Other British Countries	245,187		
Soviet Union	1,303,549		
Finland	950,905		
Estonia	1,644,940		
Latvia	1,259,027		
Lithuania	1,735,068		
Sweden	135,147		
Norway	18,062,690		
Denmark	1,848,545		
Poland	6,750		Do.
Germany	8,523,735		
Netherlands	89,101		
Belgium	99,538		
France	125,272		
Switzerland	322,273		
Italy	2,997,045		
China	153,870		
United States of America	721,205		
Argentine Republic	1,616,675		
Other Foreign Countries			
Total	79,998,957	75,847,711	62,628,680

TABLE No. 12.—QUANTITIES AND VALUES OF CORN AND FOOD PRODUCTS imported into the United Kingdom in the Year 1940, with the Corresponding Figures for 1938 and 1939.

[From Trade and Navigation Returns.]

	Quantities.			Values.		
	1938	1939.	1940.	1938.	1939.	1940.
	No.	No.	No.	£	£	£
ANIMALS, LIVING, FOR FOOD —						
Cattle	610,680			8,374,650		
Sheep and lambs	238,432			484,509		
Swine	48,186			221,746		
Total	897,298			9,083,995	10,992,660	10,892,737
GRAIN, FLOUR, &c. :	Cwt.			£		
Wheat	101,649,553			3,618,152		
Wheat meal and flour . .	7,677,890			3,980,544		
Barley	19,862,277			6,861,080		
Oats	1,572,797			586,725		
Pearl, not fresh	1,941,738			1,140,684		
Beans, not fresh	956,176			502,186		
Maize or Indian corn . .	57,628,180		do.	17,709,955		do.
Maize products	3,850,103			1,627,672		
Oat products	599,610			773,380		
All other products . . .	549,740			818,049		
Rice	2,677,091			1,186,545		
Other kinds of grain . .	421,605			171,261		
Farinaceous substances not elsewhere specified	824,788		Do.	508,287		
Total	200,214,548			74,484,439	55,446,208	93,859,241
DAIRY PRODUCTS:—	Cwt.			£		
Butter	9,508,511			50,834,739		
Margarine	108,884			150,254		
Cheese	2,928,114			9,683,627		
Cream	52,987			251,891		
Milk, condensed, un- sweetened	316,404			620,596		
Milk, condensed, sweetened	100,228			191,099		
Milk, separated or skimmed	1,217,592			1,641,049		
Milk powder, unsweetened	855,054			708,598		
Other Produce not specified	.			189,404		
Total value . . . . .	..			64,221,267		
Eggs in Shell	Thous. doz. 276,974			£ 12,373,875		
Eggs not in Shell	Cwt. 973,825			8,408,825	75,847,711	62,628,680
Total value . . . . .	..			15,777,700		

Detailed figures not available at date of publication.

not available at date of publication.

Detailed figures

Do.

TABLE No 13.—QUANTITIES AND VALUES OF MEAT OF ALL KINDS imported into the United Kingdom in the year 1940, with the corresponding figures for 1938 and 1939.

	Quantities			Values.		
	1938.	1939.	1940.	1938.	1939	1940.
BEEF:—	Cwt.	Cwt.	Cwt.	£	£	£
Fresh and salted	5,428	<i>Detailed figures not available at date of publication.</i>	<i>do.</i>	7,120	<i>Detailed figures not available at date of publication.</i>	<i>do.</i>
Chilled	8,962,451			17,671,681		
Frozen	1,654,349			2,697,889		
Boned	913,285			1,611,509		
(Other descriptions	754,957			1,778,138		
Tinned, canned, &c.—						
Tongues	88,815			733,099		
Other parts	1,000,968			2,654,619		
Extracts and Essences . .	64,754			863,127		
VEAL	438,628			1,109,022		
MUTTON AND LAMB:—		<i>Detailed figures not available at date of publication.</i>	<i>Do.</i>		<i>Detailed figures not available at date of publication.</i>	<i>Do.</i>
Mutton and Lamb—fresh .	24,047			84,661		
Mutton—frozen	1,605,184			2,811,171		
Lamb—frozen	5,284,812			16,392,997		
Tinned, canned, &c. . . .	118,597			343,521		
Other descriptions	225,961			663,392		
PIG PRODUCTS—						
Bacon	6,868,467			30,920,757		
Hams	664,474			3,016,269		
Pork—fresh	36,844			129,431		
Pork—chilled or frozen .	1,180,805			3,680,289		
Tinned, canned, &c. . . .	158,995			1,181,158		
Other descriptions	185,203			418,064		
RABBITS, fresh and frozen	253,036			457,292		
ALL OTHER KINDS OF MEAT	40,052			172,201		
POULTRY—dead	445,483			1,747,417		
GAMB—dead	25,999			120,662		
Totals	80,970,434	90,695,481	93,297,467	97,074,247

TABLE No. 14.—SUMMARY OF TOTAL VALUES appearing in Table 13 of Meat imported into the United Kingdom for the years 1938, 1939 and 1940.

	Values.		
	1938.	1939.	1940.
From—	£	£	£
Eire	3,074,532	<i>Detailed figures not available at date of publication.</i>	<i>do.</i>
Australia	11,033,785		
New Zealand	14,682,592		
Canada	6,962,548		
Other British Countries .	294,296		
Soviet Union	82,938		
Latvia	165,077		
Lithuania	869,683		
Sweden	1,160,581		
Denmark	16,260,062		
Poland	2,462,296	<i>Do.</i>	<i>Do.</i>
Netherlands	2,521,416		
France	90,759		
Hungary	695,840		
United States of America	3,366,443		
Chile	473,520		
Brazil	1,587,388		
Uruguay	2,504,589		
Argentine Republic	21,255,834		
Other Foreign Countries .	1,161,402		
Totals	90,695,481	93,297,467	97,074,247

TABLE NO. 15.—QUANTITY AND VALUE OF DEAD MEAT imported into the United Kingdom in the undermentioned Years.

	Quantities.			Values.		
	1938	1939.	1940.	1938.	1939.	1940.
Beef :—	Cwt.	Cwt.	Cwt.	£	£	£
Fresh and salted—						
Total . . .	5,423			7,120		
Chilled and frozen, from—						
Australia . . .	1,725,262			2,690,111		
New Zealand . . .	568,332			978,755		
Other British Countries . . .	111,872			209,672		
Brazil . . .	521,253			988,668		
Uruguay . . .	630,592			1,180,785		
Argentine Republic . . .	7,039,489			14,061,559		
Other Foreign Countries . . .						
Total . . .	10,596,800			20,309,570		
Boned, including Cheeks and Skirts, from—						
Australia . . .	467,050			848,342		
New Zealand . . .	336,064			572,718		
Other British Countries . . .	24,153			39,448		
Brazil . . .	33,217			63,705		
Uruguay . . .	14,051			28,107		
Argentine Republic . . .	38,564			68,896		
Other Foreign Countries . . .	136			298		
Total . . .	918,235			1,611,509		
Tongues and other descriptions from—						
Australia . . .	91,703			219,279		
New Zealand . . .	22,105			52,479		
Other British Countries . . .	19,567			55,516		
United States of America . . .	31,486			110,309		
Brazil . . .	78,335			206,136		
Uruguay . . .	37,076			81,160		
Argentine Republic . . .	472,390			1,049,171		
Other Foreign Countries . . .	2,296			4,098		
Total . . .	784,957			1,778,138		
Tinned, canned, &c.—						
Tongues—Total . . .	83,315			733,099		
Other, including Extracts & Essences						
Total . . .	1,065,722			3,017,746		
VEAL—all descriptions						
Total . . .	433,623			1,109,022		
MUTTON AND LAMB—						
Fresh—Total . . .	24,047			34,661		

Detailed figures not available at date of publication.

do.

Do.

Detailed figures not available at date of publication.

do.

Do.

TABLE NO. 15.—QUANTITY AND VALUE OF DEAD MEAT—*Continued.*

	Quantities.			Values.		
	1928.	1939.	1940.	1928.	1939.	1940.
	Cwt.	Cwt.	Cwt.	£	£	£
MUTTON—Frozen, from—						
Australia . . .	367,078			622,989		
New Zealand . .	1,014,853			1,779,394		
Other British Coun- tries . . .	2,605			4,194		
Chile . . .	96,594			166,009		
Uruguay . . .	23,713			43,859		
Argentine Republic	96,897			192,276		
Other Foreign Coun- tries . . .	1,424			2,500		
Total . . .	1,605,184			2,811,171		
LAMB—Frozen from—						
Australia . . .	1,542,034			4,572,915		
New Zealand . .	2,660,949			8,744,555		
Other British Coun- tries . . .	7,312			17,831		
Chile . . .	99,199			287,886		
Uruguay . . .	147,633			411,669		
Argentine Republic	794,736			2,245,853		
Other Foreign Coun- tries . . .	42,949			113,256		
Total . . .	5,284,812			16,892,997		
Tinned, Canned, &c.						
Total . . .	118,597		do.	338,521		do.
Other Descriptions						
Total . . .	225,961			663,392		
PIC PRODUCTS:—						
Bacon, from—						
Eire . . .	536,764			2,188,843		
Canada . . .	1,275,573			5,515,926		
Other British Coun- tries . . .	355			1,261		
Estonia . . .	42,120			181,865		
Latvia . . .	87,209			162,129		
Lithuania . . .	190,050			816,577		
Sweden . . .	251,048			1,144,113		
Denmark . . .	8,389,192			15,940,376		
Poland . . .	456,224		Do.	1,968,292		
Netherlands . .	514,438			2,836,729		
United States of America . . .	42,821			168,232		
Other Foreign Coun- tries . . .	132,673			506,914		
Total . . .	6,868,467			30,920,757		
Hams, from—						
Eire . . .	15,537			70,650		
Canada . . .	282,083			1,097,709		
Other British Coun- tries . . .	1			8		
Poland . . .	781			8,329		
United States of America . . .	395,261			1,758,778		
Argentine Republic	17,946			71,098		
Other Foreign Coun- tries . . .	2,865			14,697		
Total . . .	664,474			3,016,269		
Pork—Fresh						
Total . . .	86,844			129,431		

*Detailed figures not available at date of publication.**Do.**Detailed figures not available at date of publication.**Do.*

TABLE No. 15.—QUANTITY AND VALUE OF DEAD MEAT—*Continued.*

	Quantities.			Values.		
	1938.	1939.	1940.	1938.	1939.	1940.
	Cwt.	Cwt.	Cwt.	£	£	£
PIG PRODUCTS (contd.)—						
Pork—Chilled or frozen, from—						
Australia . . .	284,181			881,689		
New Zealand . . .	577,460			1,768,227		
Other British Countries . . .	8,201			34,212		
United States of America . . .	62,002			230,798		
Argentine Republic . . .	238,529			785,892		
Other Foreign Countries . . .	10,162			29,521		
Total . . .	1,180,805			3,680,289		
Tinned, Canned, &c.						
Total . . .	158,995			1,181,153		
Other descriptions						
Total . . .	185,208			418,064		
RABBITS—Fresh						
Total . . .	59,827			146,685		
Frozen, from—						
Australia . . .	153,380			252,288		
Other British Countries . . .	84,458			56,946		
Foreign Countries . . .	371			1,373		
Total . . .	198,209			310,607		
ALL OTHER KINDS OF MEAT—						
Tinned, Canned, &c.						
Total . . .	40,052			172,201		
POULTRY—Dead from—						
Eire . . .	101,989			458,915		
Other British Countries . . .	15,182			87,806		
Soviet Union . . .	5,579			17,426		
Netherlands . . .	24,427			110,034		
Austria . . .	447			1,862		
Hungary . . .	178,920			620,610		
Yugoslavia . . .	43,296			141,856		
Other Foreign Countries . . .	80,043			308,906		
Total . . .	445,483			1,747,417		
GAME—Dead						
Total . . .	25,399			120,662		
TOTAL of all Meat	20,970,434	90,695,481	93,297,467	97,074,247

Detailed figures not available at date of publication.

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TABLE NO. 16.—QUANTITIES AND VALUES OF BUTTER, MARGARINE, CHEESE, MILK PRODUCTS, AND EGGS imported into the United Kingdom in each Year from 1938 to 1940 inclusive.

[From Trade and Navigation Returns.]

	Quantities.			Values.		
	1938.	1939.	1940.	1938.	1939.	1940.
	Owt.	Owt.	Owt.	£	£	£
BUTTER from—						
Eire	326,604			1,914,837		
Union of South Africa	25,312			146,196		
Australia	1,797,875			9,680,407		
New Zealand	2,582,560			14,476,400		
Canada	80,017			158,028		
Other British Countries	40,771			235,349		
Soviet Union . . . . .	...				
Finland	209,714			1,056,909		
Estonia	183,159			883,897		
Latvia	339,899			1,596,885		
Lithuania	228,111			1,084,748		
Sweden	300,277			1,523,101		
Denmark	2,865,291			12,964,470		
Poland	199,073			928,692		
Netherlands	712,110			3,466,433		
Argentine Republic	89,876		do.	406,839		do.
Other Foreign Countries	77,862			362,048		
Total	9,508,511			50,834,739		
MARGARINE—	Owt.			£		
Total	108,884			150,254		
CHEESE from—	Owt.			£		
Australia	237,668			751,194		
New Zealand	1,639,486			5,466,696		
Canada	678,130			2,331,142		
Other British Countries	43,113			143,626		
Netherlands	202,339			417,345		
Switzerland	18,037		Do.	112,960		Do.
Italy	70,441			317,990		
Other Foreign Countries	38,900			142,674		
Total	2,928,114			9,683,627		
CREAM—	Owt.			£		
Total	52,987			251,891		
MILK — Con-	Owt.			£		
densed—						
Unsweetened						
Total	316,404			620,596		
Sweetened—	Owt.			£		
Whole—						
Total	100,228			191,099		

Detailed figures not available at date of publication.

Do.

Detailed figures not available at date of publication.

Do.

TABLE NO. 16.—QUANTITIES AND VALUES OF BUTTER, &c—*Continued.*

	Quantities.			Values.		
	1938.	1939.	1940.	1938.	1939.	1940.
	Cwt.	Cwt.	Cwt.	£	£	£
MILK—separated or skimmed— Total .	1,217,582			1,641,049		
MILK POWDER unsweetened— Total .	355,054			708,598		
EGGS IN SHELL from—	Thous. doz.			£		
Fire	22,140			994,570		
Union of South Africa .	2,709			156,714		
Australia .	10,099			599,991		
Other British Countries .	1,754			102,768		
Finland .	5,175		do.	234,516		do.
Sweden .	4,847			207,556		
Denmark .	95,110			4,643,118		
Poland .	26,211			878,439		
Netherlands .	59,329			2,699,408		
Belgium .	1,074			51,280		
China .	2,082			114,149		
Other Foreign Countries .	45,504			1,691,066		
Total .	276,974			12,373,875		
EGGS NOT IN SHELL— Liquid or frozen from—	Cwt		Do.	£		Do.
British Countries .	7,293			27,095		
China .	794,345			2,569,395		
Other Foreign Countries .	142,571			461,632		
Total .	944,209			3,058,122		
Eggs—other sorts	Cwt.			£		
Total .	29,616			345,703		
OTHER KINDS OF DAIRY PRODUCE— Total .				£		
Total .				139,404		
Total Value of Dairy Produce			...	79,998,957	75,847,711	62,628,680

Detailed figures not available at date of publication.

Detailed figures not available at date of publication.

TABLE No. 17.—OTHER ARTICLES AFFECTING AGRICULTURE.

	Quantities.			Values.		
	1938.	1939.	1940.	1938.	1939.	1940.
FRUIT, VEGETABLES, &c.:—	Cwt	(wt	Cw	£	£	£
Apples	7,094,802	<i>Detailed figures not available at date of publication.</i>	<i>Do.</i>	6,066,102	<i>Detailed figures not available at date of publication.</i>	<i>do.</i>
Peaches and Nectarines	106,206			251,860		
Plums, Greengages, Damsons }	520,191			522,070		
Pears	1,352,191			1,570,762		
Grapes	869,707			1,811,546		
Oranges	10,812,720			7,719,970		
Lemons, Limes, &c.	1,046,376 Bushels.			906,754		
Bananas	22,217,400 Cwt.			4,864,811		
Grape-Fruit	1,470,294			1,071,164		
Apricots	40,747			77,067		
Nuts used as Fruit	808,531			2,516,184		
Fruit (unenumerated)	1,040,958			1,210,265		
Onions	4,578,462			1,956,164		
Potatoes	2,923,190			2,052,501		
Tomatoes	2,871,651			4,742,303		
Vegetables, unenumerated (fresh) }	1,009,651			1,074,901		
Total value			38,423,004	34,992,123	27,804,012
OTHER ARTICLES:—	Cwt.	Cwt.	Cwt	£	£	£
Lard	1,442,605 Thous. lb.	<i>Detailed figures not available at date of publication.</i>	<i>do.</i>	3,187,796	<i>Detailed figures not available at date of publication.</i>	<i>do.</i>
Wool—sheep and lambs'	852,229 Piled Cubic			41,070,624		
Wood and timber— Pit-props or pit wood	685,002 Fathoms.			4,688,173		
Sawn, soft.	1,478,771 Standard.			19,721,535		
Staves	44,358 Tons.			541,846		
Feeding-stuffs for animals	1,904,166			11,422,654		
Seeds—	Cwt.					
Clover and grass	223,083 Tons			535,697		
Cotton	620,844			3,432,713		
Flax or linseed	276,391			3,585,594		
Rape	21,162			234,064		
Soya beans	98,683			766,209		
Superphosphates	14,421			84,675		
Phosphates of lime	410,805			666,621		
Nitrate-sodium	1,113,853 Cwt.			273,762		
Nitrate-potassium	50,570 Centals.			41,407		
Cotton raw of 100 lb.	12,072,240 Tons.	<i>Detailed figures not available at date of publication.</i>	<i>Do.</i>	28,379,829	<i>Detailed figures not available at date of publication.</i>	<i>Do.</i>
Hemp	87,107			2,021,597		
Flax	57,507			4,128,806		
Hides undressed—	Cwt.					
Dry	531,182			1,546,616		
Wet	834,585 Thousand			2,530,146		
Petroleum (refined)	2,640,113 Gallons.			40,857,094		
Petroleum (crude)	567,909			5,179,155		

TABLE No. 18.—NUMBER AND VALUE OF LIVE CATTLE, SHEEP, PIGS, AND OTHER ANIMALS FOR FOOD imported into the United Kingdom in the undermentioned Years. [*From Trade and Navigation Returns.*]

	Number.			Value.		
	1938.	1939.	1940.	1938.	1939.	1940.
	No.	No.	No.	£	£	£
CATTLE, from—		<i>Detailed figures not available at date of publication.</i>	<i>do.</i>		<i>Detailed figures not available at date of publication.</i>	<i>do.</i>
Eire	620,280			7,872,615		
Canada	26,450			502,035		
Other countries . . . . .	..			..
Total	646,680			8,374,650		
SHEEP AND LAMBS, from—		<i>Do.</i>	<i>Do.</i>		<i>Do.</i>	<i>Do.</i>
Eire	298,432			484,599		
SWINE, from—						
Eire	48,185			221,746		
ALL OTHER ANIMALS	949,211			186,873		
Total Value	9,220,868	10,942,600	10,892,787

TABLE No. 19.—NUMBER OF HORSES, CATTLE, SHEEP, AND PIGS imported into Great Britain from Ireland in each of the Years 1934-1940.

	1934.	1935	1936.	1937.	1938.	1939.	1940.
HORSES:—						<i>Detailed figures not available at date of publication.</i>	<i>do.</i>
Stallions	412	375	433	427	398		
Mares	4,942	4,886	4,310	4,012	3,543		
Geldings	6,830	6,744	6,190	5,412	4,312		
Total	12,184	12,005	10,933	9,851	8,253		
CATTLE: Oxen, Bulls, and Cows:—						<i>Do.</i>	<i>Do.</i>
Fat	165,006	219,207	208,813	174,991	187,559		
Store	390,823	531,316	572,560	588,073	513,064		
Other cattle	62,664	71,437	70,710	71,348	78,465		
Calves	33,963	32,204	24,755	13,426	4,204		
Total	652,456	854,164	876,838	847,838	783,292		
SHEEP:—						<i>Do.</i>	<i>Do.</i>
Sheep	161,257	194,906	256,834	171,806	210,379		
Lambs	328,959	275,071	371,062	289,332	270,485		
Total	490,216	470,067	627,896	461,138	480,864		
PIGS:—						<i>Do.</i>	<i>Do.</i>
Fat	150,634	205,026	156,994	202,477	175,489		
Store	3,745	2,564	1,412	2,978	1,954		
Total	154,429	207,590	158,406	205,455	177,443		

TABLE No. 20.—RETURN OF THE AVERAGE PRICES OF WOOL in the Years 1939 and 1940

Years.	Australian.	South African.	English Fleeces.
	Per lb.	Per lb.	Per lb.
	s. d.	s. d.	s. d.
1939	0 11½	0 4½	0 9½ to 1 2½
1940	<i>Prices not available.</i>	<i>Prices not available.</i>	<i>Prices not available.</i>

Based on a comparatively small number of transactions.

EDINBURGH CORN MARKET.

STATEMENT SHOWING THE PRICES OF WHEAT, BARLEY, AND OATS FOR THE YEAR 1940.

The Corn Sales Act of 1921 provides that all sales are to be effected by weight only, and expressed in terms of or by reference to the hundredweight of 112 lb. Experience has proved it to be convenient to quote at a price per 4½ cwt. for Wheat, 4 cwt. for Barley, and 3 cwt. for Oats.

The following statement gives a record of the year's proceedings in Edinburgh Corn Market.

1940.	WHEAT, per 4½ cwt.		BARLEY, per 4 cwt.		OATS, per 3 cwt.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
	s. d.	s. d.	d.	s. d.	s. d.	s. d.
January	8	81 6	80 0	70 0	..	..
"	0	81 6	85 0	75 0	43 0	42 0
"	17	31 6	85 0	75 0	43 0	35 6
"	4	31 6	75 0	65 0	43 0	37 0
"	31	31 6	70 0	60 0	41 0	34 0
February	7	31 6	70 0	60 0	..	..
"	14	31 6	65 0	60 0	38 9	33 0
"	21	31 6	65 0	60 0	36 0	33 0
"	28	31 6	65 0	60 0	38 6	33 0
March	6	31 6	65 0	..	37 0	34 0
"	13	31 6	65 0	62 0	36 0	33 0
"	20	31 6	70 0	65 0	36 0	33 0
"	27	31 6	70 0	65 0	36 0	33 0
April	3	31 6	70 0	65 0	36 0	33 0
"	10	31 6	70 0	66 0	36 0	33 0
"	17	31 6	70 0	66 0	36 0	33 0
"	24	31 6	68 0	64 0	36 0	33 0
May	1	31 6	68 0	64 0	36 0	33 0
"	8	31 6	68 0	64 0	36 0	33 0
"	15	31 6	70 0	65 0	36 0	33 0
"	22	31 6	70 0	65 0	36 0	33 0
"	29	31 6	70 0	65 0	36 0	33 0
June	5	31 6	70 0	65 0	36 0	33 0
"	12	31 6	70 0	65 0	36 0	33 0
"	19	31 6	70 0	65 0	36 0	33 0
"	26	31 6	70 0	65 0	36 0	33 0
July	3	31 6	70 0	65 0	36 0	33 0
"	10	31 6	70 0	65 0	36 0	33 0
"	17	31 6	70 0	65 0	36 0	33 0
"	24	31 6	70 0	65 0	36 0	33 0
"	31	..	70 0	65 0	..	..
August	7	..	70 0	65 0	43 6	..
"	14	..	70 0	65 0	43 6	..
"	28	..	70 0	65 0	43 6	..
"	21	66 0	62 0	75 0	44 6	42 0
September	4	66 0	82 0	75 0	41 0	39 0
"	11	66 0	85 0	75 0	41 0	38 6
"	18	66 0	88 0	75 0	43 0	39 0
"	25	66 0	85 0	75 0	48 6	40 6
October	2	66 0	88 0	75 0	42 6	39 0
"	9	65 3	85 0	70 0	41 6	38 0
"	16	65 3	85 0	70 0	41 6	38 0
"	23	65 3	83 0	70 0	41 6	38 0
"	30	65 3	84 0	70 0	42 0	38 6
November	6	65 3	87 0	75 0	42 6	40 0
"	13	65 3	90 0	59 0	42 6	40 0
"	20	65 3	90 0	70 0	43 0	40 6
"	27	65 3	92 0	58 0	43 6	43 0
December	4	65 3	95 0	58 0	43 6	..
"	11	65 3	95 0	58 0	43 6	..
"	18	65 3	95 0	58 0	43 6	..
"	26	65 3	95 0	59 0	43 6	..

PRICES OF SHEEP SINCE 1818.

TABLE No. 1.—CHEVIOT SHEEP.

Year.	Wethers.		Ewes.		Lambs.	
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1818	28 0	to 30 0	not quoted.		8 0	to 10 0
1819	25 0	" 27 0	15 0	to 17 0	10 6	" 12 0
1820	20 0	" 25 0	16 0	" 17 0	10 0	" 11 0
1821	18 0	" 20 0	14 0	" 16 0	7 6	" 8 0
1822	12 0	" 13 0	8 0	" 8 6	4 6	" 0 0
1823	13 6	" 18 0	7 0	" 10 6	5 8	" 6 0
1824	14 0	" 19 0	7 0	" 9 0	4 6	" 6 0
1825	29 0	" 32 0	15 0	" 19 0	9 0	" 10 6
1826	17 6	" 21 6	13 0	" 15 0	7 0	" 7 6
1827	15 0	" 24 0	not quoted.		7 0	" 8 0
1828	18 0	" 27 6	12 0	to 15 0	7 0	" 8 3
1829	18 0	" 24 0	12 6	" 14 0	7 0	" 8 6
1830	15 0	" 21 0	8 0	" 11 0	6 0	" 6 9
1831	18 0	" 25 0	9 0	" 13 0	7 0	" 8 0
1832	19 0	" 24 0	11 0	" 16 0	7 0	" 9 0
1833	22 0	" 31 0	13 6	" 20 0	8 0	" 11 3
1834	22 0	" 31 0	13 6	" 21 0	9 0	" 11 6
1835	22 0	" 27 6	18 0	" 20 6	8 0	" 11 0
1836	24 0	" 31 6	16 0	" 19 0	10 0	" 14 0
1837	19 0	" 28 0	14 0	" 19 0	10 0	" 13 0
1838	23 0	" 30 6	17 0	" 22 0	12 0	" 14 0
1839	23 0	" 31 0	14 0	" 19 0	0 0	" 18 0
1840	24 0	" 33 0	15 0	" 23 0	7 0	" 11 6
1841	23 0	" 30 0	14 0	" 22 0	8 0	" 12 0
1842	22 6	" 28 0	13 0	" 17 0	7 6	" 10 0
1843	19 0	" 25 0	8 0	" 12 0	5 0	" 8 0
1844	21 0	" 29 0	10 0	" 16 0	8 0	" 10 6
1845	23 0	" 33 0	13 0	" 20 0	8 0	" 13 0
1846	24 0	" 33 6	14 6	" 21 6	10 0	" 14 6
1847	24 0	" 35 0	13 0	" 24 0	11 6	" 15 0
1848	23 0	" 34 6	13 0	" 28 0	11 6	" 15 0
1849	21 0	" 30 2	12 0	" 21 0	0 0	" 14 0
1850	20 6	" 29 6	12 0	" 30 0	8 0	" 13 0
1851	21 6	" 31 0	13 0	" 21 0	8 9	" 14 0
1852	21 0	" 32 0	15 0	" 23 0	8 0	" 14 0
1853	26 6	" 38 0	17 0	" 28 6	9 0	" 17 0
1854	25 0	" 36 0	17 0	" 36 0	9 0	" 16 6
1855	23 6	" 36 0	16 0	" 25 0	10 0	" 17 0
1856	22 0	" 35 6	15 6	" 24 0	10 0	" 15 0
1857	24 0	" 36 0	14 6	" 26 0	10 6	" 14 6
1858	24 0	" 34 6	14 0	" 24 6	10 6	" 14 0
1859	25 0	" 34 6	16 0	" 25 0	10 3	" 14 9
1860	26 0	" 38 0	17 6	" 27 6	12 6	" 17 6
1861	25 0	" 38 6	15 0	" 28 0	9 0	" 16 0
1862	27 0	" 37 6	17 6	" 28 0	10 0	" 16 0
1863	25 0	" 38 6	19 0	" 28 6	10 6	" 16 0
1864	31 0	" 41 0	21 0	" 31 6	14 0	" 18 0
1865	32 6	" 44 0	22 6	" 35 6	14 6	" 20 0
1866	37 0	" 50 0	29 0	" 42 6	15 0	" 26 0
1867	26 0	" 58 0	18 0	" 25 6	12 0	" 16 0
1868	30 0	" 32 0	15 6	" 21 0	7 6	" 13 0
1869	28 0	" 38 0	15 0	" 22 6	7 6	" 14 0
1870	35 6	" 43 0	18 0	" 28 0	10 0	" 17 0
1871	36 6	" 40 0	22 0	" 33 6	14 0	" 20 0
1872	45 0	" 56 0	22 0	" 42 0	16 0	" 22 0
1873	42 0	" 51 0	25 0	" 42 0	16 6	" 22 0
1874	33 6	" 44 6	21 0	" 36 0	12 0	" 17 0

TABLE NO. 1.—CHEVIOT SHEEP—Continued.

Year.	Wethers.				Ewes.				Lambs.						
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.			
1875	33	0	to	48	6	21	0	to	84	0	18	6	to	23	6
1876	40	0	"	52	6	23	0	"	80	0	18	6	"	25	0
1877	41	0	"	51	0	25	0	"	87	0	15	0	"	24	0
1878	35	6	"	48	0	23	6	"	85	0	14	0	"	22	0
1879	34	0	"	44	0	21	0	"	84	0	14	0	"	20	0
1880	30	0	"	43	6	20	0	"	80	0	12	6	"	20	0
1881	32	0	"	45	6	29	0	"	84	0	14	0	"	20	0
1882	40	0	"	51	0	30	0	"	40	0	14	0	"	20	6
1883	44	0	"	55	6	34	6	"	46	6	15	6	"	23	0
1884	36	0	"	47	6	29	6	"	41	6	12	6	"	20	0
1885	30	0	"	38	0	24	0	"	31	0	12	0	"	18	0
1886	32	0	"	40	0	21	0	"	29	0	12	6	"	19	0
1887	29	0	"	36	0	18	0	"	26	0	11	0	"	16	6
1888	30	0	"	38	0	19	0	"	27	0	12	0	"	17	6
1889	36	0	"	44	0	24	0	"	32	0	14	0	"	22	0
1890	31	0	"	40	0	22	0	"	30	0	12	6	"	20	0
1891	27	0	"	38	0	16	0	"	25	0	9	0	"	16	0
1892	22	0	"	30	6	13	0	"	22	0	5	0	"	11	0
1893	26	0	"	35	6	18	0	"	28	6	8	6	"	15	0
1894	26	0	"	37	0	20	0	"	31	0	10	6	"	18	6
1895	28	0	"	39	0	22	0	"	34	0	11	6	"	19	6
1896	24	6	"	34	0	19	0	"	30	6	9	0	"	16	6
1897	27	0	"	36	0	21	0	"	31	6	11	0	"	17	6
1898	27	0	"	37	0	22	0	"	32	6	12	0	"	18	6
1899	24	0	"	33	0	20	0	"	30	6	10	6	"	16	0
1900	26	0	"	36	0	22	0	"	32	6	12	0	"	17	0
1901	25	0	"	32	6	20	0	"	29	6	11	0	"	16	0
1902	24	0	"	31	6	18	0	"	27	0	9	6	"	14	6
1903	26	0	"	34	0	21	0	"	31	0	11	4	"	18	0
1904	28	6	"	36	6	23	0	"	32	6	13	0	"	20	0
1905	27	6	"	35	0	23	0	"	33	0	14	0	"	21	0
1906	30	0	"	38	0	26	0	"	34	6	15	0	"	23	0
1907	28	0	"	34	0	22	0	"	30	6	13	6	"	19	6
1908	26	0	"	32	6	21	0	"	27	6	11	6	"	17	0
1909	24	0	"	31	0	18	0	"	25	6	9	6	"	16	0
1910	27	0	"	35	0	22	0	"	31	0	12	0	"	20	0
1911	24	0	"	31	6	18	6	"	27	6	10	6	"	18	0
1912	26	0	"	34	6	22	0	"	31	0	13	0	"	21	0
1913	30	0	"	39	0	24	0	"	35	6	16	0	"	24	0
1914	32	6	"	41	0	28	0	"	39	0	18	0	"	27	6
1915	36	0	"	46	0	31	0	"	44	0	20	0	"	30	6
1916	40	6	"	51	0	34	0	"	49	0	22	0	"	34	6
1917	43	6	"	56	0	38	0	"	56	0	24	0	"	34	0
1918	50	0	"	66	0	42	0	"	61	0	25	0	"	37	0
1919	53	0	"	69	0	44	6	"	67	0	28	0	"	40	6
1920	56	0	"	71	0	48	0	"	79	0	34	0	"	49	0
1921	45	0	"	60	0	52	3	"	85	9	33	9	"	52	3
1922	40	0	"	56	0	55	0	"	90	6	27	0	"	50	0
1923	44	0	"	65	0	61	0	"	106	0	30	0	"	62	0

Year	Wethers.				Ewes.				Lambs.											
									Wethers.				Ewes.							
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.				
1924	41	0	to	61	0	60	0	to	100	0	31	6	to	58	0	40	0	to	85	6
1925	39	8	"	50	0	56	6	"	83	9	22	3	"	50	6	36	0	"	82	0
1926	35	0	"	49	3	34	6	"	64	6	26	3	"	42	0	28	6	"	66	6
1927	28	9	"	46	3	32	6	"	55	6	23	3	"	39	0	25	3	"	52	0
1928	28	3	"	48	6	30	6	"	55	6	22	9	"	47	9	28	0	"	45	0
1929	33	6	"	54	6	34	9	"	52	0	25	6	"	47	0	30	6	"	51	9
1930	36	0	"	54	0	35	0	"	74	6	24	0	"	47	3	30	0	"	59	0
1931	24	0	"	45	6	23	0	"	50	9	17	0	"	37	0	31	0	"	57	6
1932	16	0	"	26	6	18	0	"	36	6	10	0	"	24	6	12	0	"	33	0
1933	16	0	"	28	0	25	3	"	40	0	16	6	"	31	6	19	6	"	33	0
1934	16	0	"	34	3	22	6	"	44	6	19	6	"	33	3	18	6	"	43	0
1935	22	0	"	37	3	24	0	"	44	3	16	0	"	33	3	17	0	"	40	6
1936	24	6	"	50	0	28	0	"	55	0	18	6	"	37	6	23	0	"	49	6
1937	24	6	"	49	6	29	9	"	76	6	19	0	"	45	3	27	0	"	68	0
1938	17	0	"	39	6	20	9	"	64	0	10	9	"	31	6	16	0	"	44	3
1939	19	6	"	42	9	13	6	"	43	3	11	0	"	39	9	17	0	"	48	6
1940	31	0	"	64	0	22	6	"	60	0	15	6	"	41	0	16	0	"	49	3

TABLE NO. 2.—BLACKFACE SHEEP.

Year.	Wethers.		Ewes.		Lambs.	
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1819	22 0	to 24 0	12 0	to 15 0	8 0	to 9 0
1820	20 0	" 23 8	15 6	" 17 0	7 0	" 8 6
1821	18 0	" 20 0	12 0	" 18 0	6 0	" 7 0
1822	11 6	" 18 6	5 6	" 6 0	4 6	" 0 0
1823	12 0	" 16 0	5 0	" 6 6	4 0	" 5 3
1824	9 6	" 12 6	6 0	" 7 0	4 0	" 5 0
1825	22 0	" 26 0	11 0	" 18 6	6 0	" 9 0
1826	15 0	" 17 0	8 0	" 9 0	4 6	" 6 0
1827	14 0	" 18 6	7 0	" 10 0	6 0	" 7 6
1828	15 0	" 20 0	8 0	" 11 0	5 0	" 7 6
1829	14 0	" 18 0	9 0	" 10 0	6 0	" 7 0
1830	9 6	" 13 0	4 0	" 6 0	4 6	" 6 0
1831	13 0	" 17 0	5 0	" 7 6	5 0	" 6 6
1832	14 0	" 18 0	7 0	" 11 6	6 0	" 7 8
1833	16 0	" 24 0	7 6	" 12 0	6 6	" 9 0
1834	16 0	" 22 0	10 0	" 13 0	6 0	" 8 6
1835	15 0	" 18 9	10 0	" 18 0	7 0	" 8 0
1836	15 0	" 21 0	9 0	" 12 0	8 6	" 11 0
1837	13 0	" 16 0	8 0	" 12 0	8 0	" 9 6
1838	15 0	" 20 6	10 0	" 13 0	not quoted.	
1839	15 0	" 22 0	10 0	" 12 0	7 0	to 8 8
1840	15 0	" 22 6	11 0	" 12 0	7 0	" 9 8
1841	16 0	" 20 0	9 0	" 11 0	6 0	" 8 0
1842	14 0	" 19 0	7 6	" 8 0	5 6	" 7 0
1843	not quoted.		4 9	" 6 6	not quoted.	
1844	15 0	to 21 0	6 6	" 10 0	5 0	to 8 0
1845	14 0	" 23 0	8 0	" 12 0	6 0	" 8 0
1846	13 0	" 24 0	10 0	" 18 0	8 0	" 9 0
1847	20 6	" 25 0	10 0	" 14 0	8 6	" 9 6
1848	20 0	" 24 0	11 3	" 12 0	8 6	" 10 0
1849	not quoted.		not quoted.		7 0	" 7 6
1850					7 0	" 0 0
1851	17 6	to 23 0	9 0	to 12 0	6 6	" 8 0
1852	18 6	" 22 0	9 6	" 12 0	4 6	" 7 9
1853	23 0	" 27 0	14 6	" 16 6	8 0	" 11 6
1854	20 0	" 26 0	11 0	" 16 6	8 0	" 10 6
1855	23 6	" 26 6	14 0	" 16 0	10 0	" 11 0
1856	17 0	" 24 0	10 0	" 20 0	7 6	" 10 0
1857	20 0	" 29 0	10 6	" 15 0	9 3	" 11 0
1858	20 0	" 27 6	9 9	" 18 9	8 3	" 10 6
1859	20 0	" 25 0	10 0	" 14 0	8 9	" 11 0
1860	21 0	" 27 3	11 0	" 16 0	10 0	" 13 6
1861	21 0	" 29 0	12 0	" 22 0	6 8	" 14 0
1862	16 9	" 27 0	12 0	" 18 8	6 0	" 12 0
1863	20 0	" 30 6	13 0	" 16 0	8 0	" 11 6
1864	25 0	" 30 0	15 0	" 19 0	10 0	" 13 6
1865	15 6	" 32 6	15 0	" 25 0	10 0	" 17 0
1866	31 6	" 40 0	20 0	" 36 0	18 6	" 22 6
1867	20 0	" 30 6	14 0	" 22 0	7 6	" 13 6
1868	20 0	" 26 0	10 6	" 13 6	7 0	" 18 0
1869	22 0	" 28 0	11 0	" 14 0	6 9	" 9 0
1870	27 0	" 32 6	13 0	" 22 0	8 0	" 14 6
1871	23 0	" 37 0	13 0	" 23 0	11 0	" 16 8
1872	31 6	" 45 0	18 0	" 32 0	12 6	" 18 0
1873	28 0	" 39 0	16 6	" 27 0	7 0	" 16 0
1874	25 0	" 35 0	13 0	" 30 0	7 0	" 14 0
1875	26 6	" 37 6	15 0	" 21 8	9 6	" 17 6
1876	30 0	" 40 0	19 0	" 24 0	13 0	" 20 6
1877	35 0	" 38 9	18 0	" 25 0	13 6	" 23 0
1878	30 0	" 36 0	17 0	" 23 0	12 0	" 22 0
1879	25 0	" 35 9	16 0	" 24 0	10 6	" 20 0
1880	25 0	" 38 0	16 6	" 22 6	10 0	" 17 0
1881	30 0	" 39 0	15 0	" 23 0	10 0	" 15 0
1882	33 0	" 46 0	20 0	" 28 0	12 6	" 18 6
1883	36 0	" 50 6	24 6	" 33 0	14 0	" 21 6
1884	29 0	" 43 6	19 6	" 28 0	12 0	" 19 6
1885	24 0	" 34 0	13 0	" 23 6	10 0	" 15 0
1886	25 0	" 34 0	13 0	" 22 0	10 6	" 16 0
1887	22 0	" 30 0	11 0	" 19 0	8 0	" 13 0
1888	22 0	" 32 0	13 0	" 24 0	10 0	" 15 0
1889	26 0	" 40 0	18 0	" 29 0	13 0	" 22 0

TABLE NO. 2.—BLACKFACE SHEEP—Continued.

Year.	Wethers.				Ewes.				Lambs.						
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.			
1890	24	0	to	37	0	14	0	to	27	0	10	6	to	19	0
1891	21	0	"	37	0	10	0	"	24	0	7	6	"	15	0
1892	16	0	"	28	6	6	0	"	17	0	8	0	"	10	0
1893	21	0	"	37	0	12	0	"	24	0	7	0	"	14	0
1894	20	0	"	37	0	14	6	"	26	6	8	6	"	16	6
1895	23	0	"	41	0	16	0	"	28	6	9	0	"	17	0
1896	19	0	"	35	4	18	0	"	24	0	6	0	"	13	6
1897	21	0	"	36	6	15	0	"	25	6	7	0	"	14	6
1898	22	0	"	37	0	16	0	"	26	6	8	0	"	15	0
1899	20	0	"	33	6	13	0	"	24	0	5	6	"	13	0
1900	23	0	"	36	0	16	0	"	26	6	8	0	"	15	6
1901	20	0	"	35	0	14	0	"	25	6	6	6	"	14	6
1902	18	6	"	34	0	12	0	"	24	0	6	0	"	14	0
1903	21	0	"	36	0	15	0	"	28	0	7	0	"	16	6
1904	23	0	"	38	6	18	0	"	30	0	8	6	"	17	6
1905	21	6	"	37	0	19	0	"	31	0	9	0	"	18	6
1906	23	0	"	38	0	20	0	"	33	0	10	0	"	19	6
1907	21	0	"	38	6	17	0	"	28	0	8	6	"	17	6
1908	19	6	"	30	0	15	0	"	24	6	8	0	"	16	0
1909	17	0	"	28	0	11	6	"	22	0	6	3	"	13	0
1910	21	0	"	32	6	16	0	"	27	6	8	0	"	17	0
1911	19	0	"	29	6	14	0	"	24	0	7	0	"	15	0
1912	21	6	"	32	6	17	0	"	27	6	9	6	"	17	6
1913	24	6	"	36	0	21	0	"	31	0	12	6	"	21	6
1914	27	0	"	38	6	25	0	"	34	6	15	6	"	24	0
1915	31	0	"	42	6	29	0	"	39	6	17	0	"	25	6
1916	33	0	"	46	6	31	0	"	42	0	19	0	"	27	6
1917	36	0	"	51	0	33	0	"	47	0	21	0	"	30	0
1918	41	0	"	56	0	36	0	"	50	0	27	0	"	33	0
1919	44	0	"	62	0	39	0	"	54	0	29	0	"	36	0
1920	46	0	"	66	0	44	0	"	62	0	31	0	"	43	0
1921	32	9	"	60	9	35	3	"	62	6	20	3	"	47	0
1922	40	3	"	63	0	40	6	"	74	0	18	0	"	44	0
1923	46	0	"	65	6	43	0	"	78	0	21	0	"	45	6
1924	46	0	"	68	6	45	6	"	86	0	25	0	"	55	6
1925	36	0	"	60	0	40	0	"	78	0	17	6	"	44	0

Year.	Wethers.				Ewes.				Lambs.						
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.			
1926	30	0	to	54	0	31	0	to	70	0	21	9	to	49	0
1927	26	6	"	48	0	26	0	"	64	0	17	9	"	40	0
1928	29	0	"	45	9	24	0	"	57	0	10	6	"	38	6
1929	29	9	"	46	0	29	0	"	64	0	20	3	"	43	0
1930	31	6	"	45	0	28	6	"	60	0	22	0	"	45	9
1931	19	6	"	29	9	15	0	"	34	0	14	3	"	36	9
1932	12	0	"	10	6	15	0	"	29	0	7	3	"	13	6
1933	..	..	..	..	..	20	0	"	34	0	12	9	"	19	3
1934	..	..	..	..	..	22	6	"	44	0	16	0	"	25	3
1935	..	..	..	..	..	26	0	"	40	0	16	0	"	26	9
1936	..	..	..	..	..	27	6	"	48	0	18	6	"	37	6
1937	..	..	..	..	..	32	0	"	54	0	22	6	"	39	3
1938	..	..	..	..	..	22	0	"	50	0	12	6	"	28	0
1939	..	..	..	..	..	17	6	"	40	0	12	6	"	24	6
1940	..	..	..	..	..	22	6	"	50	0	16	0	"	35	3

TABLE NO. 3.—PRICE OF WOOL, PER STONE OF 24 LB., SINCE 1818.

Year.	Laid Cheviot.		White Cheviot.		Laid Highland.		White Highland.	
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1818	40 0	to 42 2	..	..	20 0	to 22 6	..	..
1819	21 0	" 22 0	..	..	10 0	" 10 8	..	..
1820	20 0	" 22 0	..	..	9 0	" 10 0	..	..
1821	18 0	" 20 0	..	..	9 0	" 10 0	..	..
1822	12 6	" 14 6	..	..	5 0	" 6 6	..	..
1823	9 0	" 10 6	..	..	5 0	" 5 9	..	..
1824	18 6	" 15 0	..	..	0 0	" 6 8	..	..
1825	10 6	" 22 0	..	..	10 0	" 10 6	..	..
1826	11 0	" 14 0	..	..	5 0	" 5 6	..	..
1827	11 0	" 14 0	..	..	5 6	" 6 9	..	..
1828	8 0	" 11 0	..	..	5 6	" 6 0	..	..
1829	8 6	" 11 0	..	..	4 3	" 0 0	..	..
1830	9 6	" 11 0	..	..	4 6	" 5 0	..	..
1831	17 0	" 20 0	..	..	7 6	" 8 0	..	..
1832	14 0	" 16 0	..	..	7 0	" 7 6	..	..
1833	18 0	" 20 7	..	..	10 0	" 11 0	..	..
1834	21 0	" 24 6	..	..	5 6	" 7 0	..	..
1835	19 0	" 20 6	..	..	9 6	" 10 8	..	..
1836	21 0	" 25 0	..	..	10 0	" 14 0	..	..
1837	12 0	" 14 0	..	..	7 0	" 7 8	..	..
1838	19 0	" 22 6	..	..	6 0	" 10 0	..	..
1839	18 0	" 20 0	..	..	8 0	" 12 0	..	..
1840	15 0	" 0 0	..	..	7 0	" 0 0	..	..
1841	15 0	" 16 9	..	..	6 0	" 7 5	..	..
1842	12 6	" 14 0	..	..	not quoted.	..	..	..
1843	9 0	" 11 6	..	..	5 0	to 6 0	..	..
1844	15 0	" 18 0	..	..	not quoted.	..	..	..
1845	14 6	" 17 6	..	..	7 6	to 8 6	..	..
1846	12 0	" 14 6	..	..	8 0	" 8 6	..	..
1847	12 6	" 14 0	..	..	not quoted.	..	..	..
1848	9 6	" 11 0	..	..	4 9	to 0 0	..	..
1849	12 0	" 16 6	..	..	6 0	" 0 3	..	..
1849	15 0	" 17 6	..	..	5 0	" 8 6	..	..
1850	12 0	" 16 0	..	..	8 0	" 9 3	..	..
1851	13 0	" 15 0	..	..	8 0	" 9 0	..	..
1852	19 0	" 22 0	..	..	11 0	" 12 6	..	..
1853	12 0	" 15 0	..	..	7 6	" 8 6	..	..
1854	14 6	" 19 0	..	..	8 6	" 9 0	..	..
1855	19 0	" 21 6	..	..	11 0	" 0 0	..	..
1856	19 0	" 24 0	..	..	13 0	" 14 3	..	..
1857	15 0	" 17 0	..	..	8 9	" 10 0	..	..
1858	18 6	" 24 0	..	..	10 9	" 11 6	..	..
1859	22 0	" 32 0	37 0	to 38 0	10 0	" 11 3	..	..
1860	19 6	" 27 0	from 30s. upwards	..	not quoted.	..	..	..
1862	18 6	" 26 0	30 0	to 37 0	11 6	to 16 0	..	..
1863	25 0	" 31 0	38 0	" 42 0	15 3	" 17 6	..	..
1864	31 0	" 39 0	47 0	" 54 0	17 6	" 20 0	..	..
1865	23 0	" 30 0	44 0	" 45 0	15 0	" 17 0	..	..
1866	24 0	" 30 0	30 0	" 38 0	14 0	" 16 0	..	..
1867	16 0	" 21 6	not quoted.	..	not quoted.	..	..	..
1868	19 0	" 26 0	28 0	to 32 0	8 6	to 9 0	..	..
1869	18 0	" 26 6	not quoted.	..	8 6	" 10 0	..	..
1870	15 0	" 23 6	25 0	to 26 0	9 8	" 0 0	..	..
1871	20 0	" 26 6	80 0	" 84 6	12 0	" 15 0	..	..
1872	26 0	" 37 6	40 0	" 48 0	18 0	" 21 0	..	..
1873	17 0	" 18 0	34 0	" 40 0	9 0	" 12 0	..	..
1874	16 6	" 26 6	30 0	" 34 0	9 6	" 13 0	..	..
1875	25 0	" 32 0	84 6	" 86 0	12 6	" 16 0	..	..
1876	20 0	" 24 0	80 0	" 84 6	9 6	" 12 0	..	..
1877	20 9	" 26 0	28 0	" 30 0	10 0	" 12 0	..	..
1878	18 9	" 25 0	27 0	" 32 0	8 6	" 11 6	..	..
1879	15 0	" 17 0	prices very low.	..	7 0	" 0 0	..	..
1880	20 0	" 24 0	30 0	to 32 0	10 6	" 11 6	14 0	to 16 0
1881	17 0	" 21 0	27 0	" 30 0	5 0	" 9 6	12 0	" 13 0
1882	14 0	" 18 0	27 6	" 28 0	7 6	" 9 0	12 0	" 14 0
1883	13 0	" 18 0	26 0	" 28 0	6 6	" 8 6	11 6	" 12 6
1884	13 0	" 18 0	26 0	" 28 0	6 0	" 8 6	11 6	" 12 6
1885	12 0	" 17 0	22 0	" 26 0	6 0	" 8 0	11 6	" 12 0
1886	15 0	" 18 0	23 0	" 27 6	6 6	" 8 6	11 6	" 12 0
1887	14 0	" 32 0	23 0	" 28 0	7 0	" 9 0	11 6	" 13 0
1888	13 0	" 20 0	23 0	" 28 0	7 0	" 9 0	11 0	" 12 6

TABLE NO. 3 --PRICE OF WOOL--Continued.

Year.	Laid Cheviot.			White Cheviot.			Laid Highland.			White Highland.		
	s.	d.	s. d.	s.	d.	s. d.	s.	d.	s. d.	s.	d.	s. d.
1889	13	0	to 18 0	24	0	to 28 0	7	0	to 9 0	11	0	to 12 6
1890	13	0	" 18 0	24	0	" 28 0	7	0	" 9 0	11	0	" 12 6
1891	12	6	" 18 0	22	0	" 28 0	7	0	" 9 0	11	0	" 12 6
1892	12	0	" 18 0	20	0	" 28 0	7	0	" 8 6	10	6	" 12 0
1893	12	0	" 17 0	20	0	" 27 0	7	0	" 8 0	10	0	" 12 0
1894	12	0	" 16 0	20	0	" 26 0	7	0	" 8 0	10	0	" 12 0
1895	12	0	" 16 0	20	0	" 25 0	7	0	" 8 0	10	0	" 11 6
1896	11	0	" 15 0	19	0	" 24 0	7	0	" 8 0	10	0	" 11 6
1897	11	0	" 14 0	18	0	" 23 0	7	0	" 8 0	10	6	" 12 0
1898	10	0	" 13 0	16	0	" 20 0	7	0	" 8 0	10	0	" 11 6
1899	10	0	" 13 0	18	0	" 18 6	7	0	" 8 0	8	6	" 9 6
1900	9	9	" 12 0	18	0	" 18 6	6	9	" 7 9	8	0	" 9 6
1901	9	0	" 10 0	11	0	" 16 6	5	9	" 6 6	8	0	" 9 0
1902	9	0	" 10 0	11	6	" 17 0	6	0	" 6 6	8	6	" 9 6
1903	10	0	" 12 0	15	0	" 15 0	7	0	" 8 0	11	6	" 12 6
1904	15	0	" 17 0	20	0	" 21 0	9	0	" 10 0	14	0	" 15 0
1905	17	0	" 20 0	24	0	" 26 0	10	0	" 11 0	15	0	" 16 0
1906	18	0	" 21 0	27	0	" 28 6	11	6	" 13 0	16	6	" 17 6
1907			" *	22	0	" 24 0	11	0	" 12 6	16	0	" 17 0
1908			" *	16	0	" 18 0	†			8	0	" 8 6
1909			" *	24	0	" 26 0	†			12	6	" 14 0
1910			" *	25	0	" 30 0	†			13	0	" 14 6
1911			" *	25	0	" 30 0	†			13	0	" 14 6
1912			" *	24	0	" 29 0	†			14	0	" 15 0
1913			" *	25	0	" 30 0	†			17	0	" 18 0
1914			" *	24	0	" 29 0	†			15	0	" 15 6
1915†			" *	42	0	" 46 0	†			21	0	" 22 0

* No Cheviots smeared now

† No Highlands smeared now

‡ These are July prices.

PRICE OF WOOL PER STONE OF 24 LB.—Continued.

		CHEVIOT.				HALF-BRED.				BLACK-FACE.		CROSS-BRED (BLACKFACE EWE AND LIMESTER RAM).			
		Hogg.		EWE AND WETHER.		Hogg.		EWE AND WETHER.		Hogg.	EWE AND WETHER.	Hogg.		EWE AND WETHER.	
		Washed.	Un- washed.	Washed.	Un- washed.	Washed.	Un- washed.	Washed.	Un- washed.			Washed.	Un- washed.	Washed.	Un- washed.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1 1916	CAITHNESS & SUTH- ERLAND	34 6	30 0	33 0	27 6	34 0	28 6	33 0	27 6	23 0	23 0	28 6	25 6	28 6	25 6
1 1917	CAITHNESS & SUTH- ERLAND	40 0	32 6	34 0	29 0	35 0	29 0	34 0	28 6	25 6	25 6	31 0	28 6	31 6	28 6
1 1918	CAITHNESS & SUTH- ERLAND	40 6	33 0	37 0	31 0	38 6	31 6	37 0	31 6	27 0	27 0	33 6	30 6	33 6	30 6
1919	CAITHNESS & SUTH- ERLAND	44 6	36 0	37 6	32 6	39 0	32 6	37 6	31 0	34 0	34 0	46 0	39 0	44 0	38 0
1920	CAITHNESS & SUTH- ERLAND	43 6	35 6	39 6	33 0	41 0	33 6	39 6	33 0	24 0	24 0	35 0	29 0	34 0	27 0
1921	CAITHNESS & SUTH- ERLAND	47 6	38 6	40 0	34 6	41 6	34 6	40 0	33 6	9 6	9 6	12 0	10 0	12 0	10 0
1922	CAITHNESS & SUTH- ERLAND	84 0	70 0	82 0	66 0	82 0	62 0	70 0	58 0	16 0	16 0	16 6	15 0	16 6	15 0
1923	CAITHNESS & SUTH- ERLAND	88 0	74 0	84 0	68 0	84 0	63 0	72 0	60 0	17 6	17 6	20 0	18 0	20 0	18 0
1924	CAITHNESS & SUTH- ERLAND	86 0	70 0	83 0	66 0	74 0	54 0	65 0	50 0	25 6	25 6	34 6	30 6	33 0	30 0
1925	CAITHNESS & SUTH- ERLAND	90 0	74 0	87 0	68 0	76 0	56 0	68 0	52 0	25 6	25 6	26 0	23 6	25 6	23 0
1926	CAITHNESS & SUTH- ERLAND	22 0	17 0	19 0	15 0	18 6	14 6	16 0	13 0	19 0	19 0	22 6	20 0	22 0	19 6
1927	CAITHNESS & SUTH- ERLAND	23 0	18 0	20 0	16 0	19 6	15 6	17 0	14 0	24 0	24 0	27 0	25 6	27 0	25 0
1928	CAITHNESS & SUTH- ERLAND	50 0	25 6	26 0	22 0	26 0	20 0	22 0	18 0	24 6	24 6	33 0	31 0	32 0	30 0
1929	CAITHNESS & SUTH- ERLAND	31 6	26 0	27 0	23 0	27 0	21 0	23 0	19 6	24 0	24 0	27 0	25 0	26 0	24 0
1930	CAITHNESS & SUTH- ERLAND	41 0	34 0	36 0	30 0	33 0	27 0	30 0	25 0	24 0	24 0	27 0	25 0	26 0	24 0
1931	CAITHNESS & SUTH- ERLAND	43 0	35 0	37 6	31 0	34 0	28 0	31 0	26 0	25 6	25 6	34 6	30 6	33 0	30 0
1932	CAITHNESS & SUTH- ERLAND	58 0	49 0	53 0	45 0	49 0	40 0	45 0	39 0	25 6	25 6	34 6	30 6	33 0	30 0
1933	CAITHNESS & SUTH- ERLAND	60 0	50 0	51 0	46 0	50 0	41 0	46 0	40 0	25 6	25 6	26 0	23 6	25 6	23 0
1934	CAITHNESS & SUTH- ERLAND	39 0	34 0	36 0	30 0	33 6	28 6	32 0	27 0	19 0	19 0	22 6	20 0	22 0	19 6
1935	CAITHNESS & SUTH- ERLAND	40 0	35 0	37 0	31 0	34 0	29 0	33 6	28 0	24 0	24 0	27 0	25 6	27 0	25 0
1936	CAITHNESS & SUTH- ERLAND	35 0	29 0	32 0	28 0	32 0	26 6	28 0	24 6	19 0	19 0	22 6	20 0	22 0	19 6
1937	CAITHNESS & SUTH- ERLAND	36 0	30 0	33 0	29 0	33 0	27 6	29 0	25 6	24 0	24 0	27 0	25 6	27 0	25 0
1938	CAITHNESS & SUTH- ERLAND	38 0	31 0	35 0	31 0	34 6	29 6	32 0	27 6	24 0	24 0	27 0	25 6	27 0	25 0
1939	CAITHNESS & SUTH- ERLAND	39 0	32 0	36 0	32 0	35 0	30 0	33 0	28 6	24 6	24 6	33 0	31 0	32 0	30 0
1940	CAITHNESS & SUTH- ERLAND	51 0	43 0	45 0	41 0	47 0	40 0	43 0	37 0	24 6	24 6	33 0	31 0	32 0	30 0
1941	CAITHNESS & SUTH- ERLAND	52 0	44 0	49 0	42 0	48 0	41 0	44 0	38 0	24 0	24 0	27 0	25 0	26 0	24 0
1942	CAITHNESS & SUTH- ERLAND	37 0	32 0	34 0	29 0	34 0	29 0	32 6	27 0	24 0	24 0	27 0	25 0	26 0	24 0
1943	CAITHNESS & SUTH- ERLAND	23 0	19 0	22 0	18 0	21 0	17 6	20 0	16 6	12 0	12 0	17 6	15 6	16 6	15 6
1944	CAITHNESS & SUTH- ERLAND	16 6	13 6	15 6	13 0	15 0	13 0	13 6	11 6	11 0	11 0	12 0	10 6	11 6	10 0
1945	CAITHNESS & SUTH- ERLAND	14 6	11 6	14 0	11 6	12 6	11 6	11 6	9 6	8 0	8 0	9 0	8 6	8 0	7 6
1946	CAITHNESS & SUTH- ERLAND	20 0	17 0	19 0	16 0	18 0	16 0	17 0	14 0	11 6	11 6	12 0	11 0	11 6	11 0
1947	CAITHNESS & SUTH- ERLAND	21 6	17 6	21 0	17 0	19 0	17 0	17 0	14 0	10 0	10 0	12 0	11 0	12 0	11 0
1948	CAITHNESS & SUTH- ERLAND	26 0	21 0	24 6	19 6	21 6	19 0	19 0	17 0	10 6	10 6	14 0	12 6	14 0	12 6
1949	CAITHNESS & SUTH- ERLAND	27 0	22 0	25 6	20 0	21 6	19 6	19 0	17 0	14 0	14 0	17 0	16 0	17 0	16 0
1950	CAITHNESS & SUTH- ERLAND	39 0	35 0	38 0	33 6	34 6	32 0	34 6	31 6	26 0	26 0	32 0	29 0	32 0	29 0
1951	CAITHNESS & SUTH- ERLAND	22 0	19 6	21 6	18 6	21 0	18 6	19 0	16 6	12 0	12 0	16 0	14 6	16 0	14 6
1952	CAITHNESS & SUTH- ERLAND	26 0	22 0	25 6	21 6	24 0	21 6	23 6	21 6	16 0	15 0	21 0	19 0	21 0	19 0
1953	CAITHNESS & SUTH- ERLAND	37 0	30 6	37 0	30 6	33 0	29 6	33 0	29 6	25 0	25 0	28 6	26 0	28 6	26 0

1 The prices given were prices fixed by Government, and not free market prices.

VETERINARY DEPARTMENT.

CLASS EXAMINATIONS, 1940.

Silver Medals were awarded to the following :—

GLASGOW VETERINARY COLLEGE.

Chemistry	C. A. Hartman-Smith, Bearsden.
Biology	C. A. Hartman-Smith, Bearsden.
Senior Anatomy	J. B. Bayliss, Wishaw.
Junior Anatomy	David Buntain, Croy.
Physiology	G. W. Serth, Lincoln.
Zootechny	A. C. L. Brown, Glasgow.
Pathology	C. C. Moore, Glasgow.
Hygiene	J. B. Bayliss, Wishaw.
Surgery	Andrew Wilson, Hull.
Medicine	Andrew Wilson, Hull.
Histology	R. W. Bryson, Cambuslang.
Pharmacology	R. I. Thain, Newnham.
Parasitology	Robert Auld, Stewarton.

13 Large Silver Medals, £12, 0s. 6d.

ROYAL (DICK) VETERINARY COLLEGE.

Chemistry	G. E. M. Latimer, Cheshire.
Biology	P. D. I. Thomas, Glamorgan.
Senior Anatomy	W. Tait, Dumfriesshire.
Junior Anatomy	M. M. MacKinnon, Dumbartonshire.
Physiology	R. R. A. Coombs, South Africa.
Zootechny	J. S. Dovey, China.
Pathology	I. H. Pattison, Edinburgh.
Hygiene	J. L. M'Girr, Lanarkshire.
Surgery	J. Millar, Newton Stewart.
Medicine	A. M'Diarmid, Edinburgh.
Histology	R. R. A. Coombs, South Africa.
Pharmacology	D. W. Macdonald, Dumfriesshire.
Parasitology	J. Cruickshanks, Angus.

13 Large Silver Medals, £12, 0s. 6d.

DISTRICT COMPETITIONS, 1940.

1 District—1 Grant of £12	. . . . .	£12 0 0
17 Districts—Grants of £15 each	. . . . .	255 0 0
Special Grants : Medals, £9, 16s.	. . . . .	56 16 0
Medals for Shows (3 large)	. . . . .	3 4 6
Premiums and Medals for Cottages, Gardens, &c.	. . . . .	0 11 6
7 „ Medals for Hoeing Competitions, 1939-40	. . . . .	2 14 3
8 „ Medals for Ploughing, 1939-40	. . . . .	4 0 0
Long Service Certificates, £24, 4s. 1d. ; Gold Medals, £18, 2s. 6d. ; and Silver Medals, £16, 12s. 6d. (1939-40)	. . . . .	58 19 1
		£393 5 4

ABSTRACT OF PREMIUMS.

District Competitions	. . . . .	£334 6 3
Long Service Awards	. . . . .	58 19 1
Veterinary Colleges (26 Medals)	. . . . .	24 1 0
		<hr/> £417 6 4

EDINBURGH SHOW, 1939.

ALTERATIONS IN PRIZE LIST.

On account of animals failing to comply with the Regulations as to calving and foaling, the following changes have taken place in the list of animals for which prizes were awarded:

CATTLE.

ABERDEEN-ANGUS.

CLASS 16. COW or HEIFER, born on or after 1st December 1936 and before 1st December 1937.—PREMIUMS, £10, £5, £3, and £2.

- 1st No. 131 Reid, Andrew T., Auchterarder House, Auchterarder, Heifer, "Kindella of Auchterarder" (116,889).
 2nd No. 129 Kerr, J. E., of Harviestoun, Dollar, Heifer, "Erska of Harviestoun" (115,964).
 3rd No. 128 Ivory, Basil G., of Binny, Uphall, West Lothian, Cow, "Barmaid of Garvault" (115,551).
 * No. 124 Beddie, J. & A., Banks, Strichen, Heifer, "Gammer Ebleta" (114,433).
 4th No. 127 Hamilton, William, Tullochgribban, Grantown-on-Spey, Heifer, "Eileon of Balnain" (115,529).
 H No. 134 Russell, G. H., of The Burn, Glensok, Brechin, Heifer, "Evalida" (116,768).
 C No. 135 Templeton, T. & M., Sandyknowe, Kelso, Heifer, "Eglatta of Sandyknowe" (117,403).
 C No. 130 Macbeth, W. Gilchrist, of Dunira, Comrie, Heifer, "Godiva of Auchterarder" (116,887).
 C No. 125 Elgin, The Earl of, K.T., C.M.G., Broomhall, Dunfermline, Heifer, "Ervabell of Broomhall" (115,115).
 C No. 136 Templeton, T. & M., Sandyknowe, Kelso, Heifer, "Electra of Sandyknowe" (117,404).

GALLOWAY.

CLASS 23. COW or HEIFER, born on or after 1st December 1936 and before 1st December 1937.—PREMIUMS, £10, £5, £3, and £2.

- * No. 185 Carruthers, Lieut.-Colonel F. J., of Dormont, Lockerbie, Heifer, "Nell 2nd of Dormont" (38,780).
 1st No. 187 Graham, Robert, Chapel of Logan, Canonbie, Heifer, "Logan Lady 51st" (38,993).
 2nd No. 186 Graham, Robert, Chapel of Logan, Canonbie, Heifer, "Logan Lady 52nd" (38,992).

The animals failing to qualify are marked thus ().*

- * No. 184 Buchanan-Jardine, Sir John William, of Castle Milk, Bt., Castle Milk, Lockerbie, Heifer, "Bell of Castle Milk" (39,047).
- 3rd No. 188 Kennedy-Moffat, W., Auchencheyne, Moniaive, Dumfriesshire, Heifer, "Gloria of Lochurr" (39,056).
- 4th No. 190 Paterson, Robert Jardine, Balgray, Lockerbie, Heifer, "Marina of Balgray" (39,427).
- C No. 191 Paterson, Robert Jardine, Balgray, Lockerbie, Heifer, "Minerva of Balgray" (39,432).
- C No. 189 Kennedy-Moffat, W., Auchencheyne, Moniaive, Dumfriesshire, Heifer, "Titian of Lochurr" (39,062).

BRITISH FRIESIAN.

CLASS 50. HEIFER, born in 1937.—PREMIUMS, £10, £6, £4, and £2.

- 1st No. 406 MacRobert Trustees, Douneside, Melgum, and Cromar Estate Office, Tarland, Aberdeenshire, "Douneside Lod Lorna 2nd" (224,446).
- 2nd No. 401 Johnston, Thomas, & Son, Standalane, Falkirk, "Standalane Bert Daisybud" (231,496).
- 3rd No. 412 Weightman, Albert, Middle Herrington Farm, Sunderland, "Herrington Gentle Ruth" (226,554).
- * No. 411 Weightman, Albert, Middle Herrington Farm, Sunderland, "Herrington Rosalind" (226,598 P.I.).
- 4th No. 404 Logan, James, Powis Mains, Stirling, "Powis Nora-Lin 11th" (230,138).
- 11 No. 409 Moffitt, John E., Peepay, Stocksfield-on-Tyne, Northumberland, "Dalton Marlette" (224,080).
- C No. 403 Logan, James, Powis Mains, Stirling, "Powis Nora-Lin 10th" (230,136).
- C No. 400 Hall, Ernest B., Hales Hall, Market Drayton, Shropshire, "Hales Thelma 6th" (226,092 P.I.).
- C No. 408 MacRobert Trustees, Douneside, Melgum, and Cromar Estate Office, Tarland, Aberdeenshire, "Douneside Lod Beauty" (224,436).

HORSES.

CLYDESDALE.

CLASS 64. YELD MARE, born before 1936.—PREMIUMS, £15, £9, £6, and £4.

- 1st No. 527 Montgomerie, A. W., Westburn Farm, Cambuslang, "Westburn Cinnabar."
- * No. 528 Park, Misses M. & J., Brunstane, Portobello, "Collairnie Nannie" (62,742).
- * No. 529 Roy, James, Ransfield, Ratho, Midlothian, "Ransfield Rena" (64,570).
- 2nd No. 524 Cairns, James, Lochmalony, Cupar, Fife, "Lochmalony Ella" (58,853).
- * No. 525 Jackson, Robert, Reedyloch, Duns, "Reedyloch Beneventa" (64,230).
- 3rd No. 526 M'Laren, William, & Sons, Fairnington, Roxburgh, "Farida."

The animals failing to qualify are marked thus ().*

STATE OF THE FUNDS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

As at 30th NOVEMBER 1940

GENERAL FUNDS.

I. BRITISH GOVERNMENT SECURITIES—		
£25,000 3½ per cent War Loan, at 102½	£25,609 7 6	
£1,679, 18s. 4d. 2½ per cent Consolidated Stock, at 76½	1,278 13 0	
£20,000 3½ per cent Conversion Loan, at 102½	20,525 0 0	
£2,500 3 per cent Do. do. at 102½	2,568 15 0	
£5,000 3 per cent Funding Loan, at 98½	4,943 15 0	
£1,000 3 per cent Defence Bonds, at par	1,000 0 0	
£10,000 3 per cent War Loan, at 100½	10,087 10 0	
	£66,013 0 6	
II. HERITABLE BOND—		
£2,500 at Commissioners' Rates	2,500 0 0	
III. RAILWAY DEBENTURE AND PREFERENCE STOCKS—		
£17,050 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 69½	£11,849 15 0	
£11,554 Do. do. 4 per cent do., at 93½	10,715 4 5	
£16,105 London Midland and Scottish Railway Co. 4 per cent Debenture Stock, at 98½	15,863 8 6	
£1,500 Do. do. 4 per cent Preference Stock, at 51	765 0 0	
£708 Southern Railway Co. 4 per cent Debenture Stock, at 102½	720 11 6	
£450 Do. do. 5 per cent Preference Stock, at 83½	375 15 0	
£112 Do. do. 5 per cent Guaranteed Stock, at 111	124 6 5	
	40,444 0 10	
IV. BANK STOCKS—		
£5,365 0 0 Royal Bank of Scotland Stock, at 405 x.d.	£21,728 5 0	
£2,218 16 5 Bank of England Stock, at 33½	7,410 17 2	
£1,777 0 0 Bank of Scotland Stock, at 51s.	4,531 7 0	
2,850 "B" Shares, Barclays Bank, Ltd., at 63s. 6d.	9,048 15 0	
	42,719 4 2	
V. COLONIAL GOVERNMENT STOCKS—		
£2,000 Western Australia Inscribed 4 per cent Stock (1942-62), at 101 x.d.	£2,020 0 0	
£2,000 New Zealand Government 5 per cent Inscribed Stock (1946), at 104	2,080 0 0	
£1,120 Victorian Government 3½ per cent Inscribed Stock (1929-49), at 100	1,120 0 0	
	5,220 0 0	
VI. CORPORATION MORTGAGE—		
£5,000 on Loan to Edinburgh Corporation at 4 per cent, maturing Martinmas 1944	5,000 0 0	
VII. TEMPORARY LOAN—		
£2,000 on Loan to Edinburgh Corporation	2,000 0 0	
VIII. ESTIMATED VALUE of Building—		
8 Eglinton Crescent	5,000 0 0	
IX. ESTIMATED VALUE of Furniture, Paintings, Books, &c.		
	1,500 0 0	
Carry forward	£170,396 5 6	

	Brought forward	£170,896 5 6
X. ARREARS OF SUBSCRIPTIONS considered recoverable		443 10 6
XI. BALANCES at 30th November 1940		605 1 2
AMOUNT OF GENERAL FUNDS		£171,444 17 2

SPECIAL FUNDS.

TWEEDDALE GOLD MEDAL FUND—

£605 London and North-Eastern Railway Co. 4 per cent Debenture Stock, at 98		£562 13 0
£100 3 per cent Local Loans Stock, at 88½		88 17 6
Sum on Deposit Receipt with British Linen Bank		20 1 7
		£671 12 1

FIFE AND KINROSS PERPETUAL GOLD CHALLENGE CUP FUND—

£268 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 69½	£186 5 3	
£201 Do. do. 4 per cent First Guaranteed Stock, at 73½	147 14 9	
Sum on Deposit Receipt with British Linen Bank	70 5 11	
		404 5 11

PAISLEY PERPETUAL GOLD CHALLENGE CUP FUND—

£302 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 69½	£557 7 10	
Sum on Deposit Receipt with British Linen Bank	123 10 1	
		680 17 11

RENFREWSHIRE PERPETUAL GOLD CHALLENGE CUP FUND—

£668 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 69½	£464 5 2	
Sum on Deposit Receipt with British Linen Bank	127 4 0	
		591 9 2

WILLIAM TAYLOR MEMORIAL PRIZE FUND—

£401 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 69½	£278 14 0	
Sum on Deposit Receipt with British Linen Bank	130 17 3	
		409 11 3

WILLIAM DUTHIE PERPETUAL SILVER CHALLENGE CUP FUND—

£260 2½ per cent Consolidated Stock, at 76½	£197 18 6	
Sum on Current Account with British Linen Bank	6 14 11	
		204 13 5

THE JAMES ARCHIBALD PRIZE—

£612, 1s. 6d. 3½ per cent War Loan, at 102½	£627 0 0	
Sum on Current Account with Royal Bank of Scotland	10 14 2	
		637 14 2

KINMONTH GOLD QUACH FUND—

£46, 13s. 6d. 3½ per cent War Loan, at 102½	£47 16 3	
Sum on Current Account with British Linen Bank	1 9 8	
		49 5 11

AMOUNT OF SPECIAL FUNDS . . . £3,649 9 10

EDINBURGH, 8th January 1941.—As Auditor of the Highland and Agricultural Society of Scotland, I have examined the Securities for the Investments as detailed in the above State of the Funds and have found them in order. The Titles to the Heritable Estate and the Bond for Sum lent on Heritable Security are certified by the Society's Law Agents to be in order.

GEO. JAMES GREGOR, C.A.

HOME, Treasurer.

F. J. CARRUTHERS, Hon. Secretary.

ABSTRACT of the ACCOUNTS of the HIGHLAND and CHARGE.

1. BALANCES at 30th November 1939	£1,185 17 1	
2. ARREARS of Subscriptions outstanding at 30th November 1939	£245 18 6	
Whereof due by Members who have compounded for life, and whose arrears are thereby extinguished	6 0 0	
		239 18 6
3. INTEREST AND DIVIDENDS—		
(1) Interest—		
On Heritable Bond, less Income-tax	£57 8 6	
On Railway Debenture and Preference Stocks, do.	1,038 4 10	
On Colonial Government Stocks, do.	130 10 10	
On British Government Stocks, do.	1,544 17 0	
On Mortgage, do.	115 0 0	
On Temporary Loans, do.	22 8 8	
On Deposit Receipts	39 13 3	
	£2,948 3 1	
(2) Dividends on Bank Stocks, less Income-tax	1,106 12 8	
		4,054 15 9
4. SUBSCRIPTIONS—		
Annual Subscriptions	£2,179 15 6	
Life Subscriptions	460 19 0	
		2,640 14 6
5. 'TRANSACTIONS'—Sales and Other Receipts		30 12 11
6. INCOME-TAX repaid for year to 5th April 1940		1,845 2 3
7. BALANCE of Receipts from Edinburgh Show, 1939		198 11 4
8. N.D.D. EXAMINATION at Ayr, 1939—Refund of Expenses		76 18 8
9. DEPOSIT RECEIPTS uplifted		10,375 0 0
10. MISCELLANEOUS		18 8 10
SUM OF CHARGE	£20,665 19 10	

EDINBURGH, 8th January 1941.—As Auditor of the Highland and Agricultural of the Society for the year ending 30th November 1940 and have found them to be Accounts I have prepared an Account of Charge and Discharge of the Intremissions 1940, of which the above is an Abstract.

AGRICULTURAL SOCIETY of SCOTLAND for Year 1939-1940.

DISCHARGE.

1. ESTABLISHMENT EXPENSES—		
Salaries and Wages and Allowance for Cleaning	£3,263 11 8	
Allowance to Mrs Cowie	100 0 0	
Fen-duty, £18, 19s. 3d.; Rates and Taxes, £91, 11s. 6d.	110 10 9	
Coal, Gas, and Electric Light	76 4 1	
Insurances, £60, 14s. 4d.; Insurance of Show Plant, &c., £61, 9s. 3d.; Special Annuity Premium, £51, 3s. 9d.; Superannuation Scheme, £123, 15s. 4d.; Telephone and Telegrams, £50, 12s. 11d.; Repairs and Furnishings, £62, 10s. 0d.	410 9 7	
	£3,960 16 1	
2. FEE to Auditor of Accounts for 1938-1939	120 0 0	
3. EDUCATION—N.D.A. Examinations, 1940	223 4 11	
4. CHEMICAL DEPARTMENT—		
Fee to Chemist	£100 0 0	
Analyses for Members and Expenses	145 19 9	
	245 19 9	
5. VETERINARY DEPARTMENT—Medals to Students	24 1 0	
6. DAIRY DEPARTMENT—N.D.D. Examination, 1939	73 3 1	
7. DAIRY DEPARTMENT, 1940—		
Expenses of N.D.D. Examination held at Ayr	£281 17 0	
Less Entry Fees	118 13 0	
	113 4 0	
8. SOCIETY'S 'TRANSACTIONS'	1,477 10 3	
9. ORDINARY Printing, £171, 8s. 3d.; Advertising, £41, 18s. 6d.; Stationery, Books, &c., £86, 19s. 1d.; Postages and Receipt Stamps, £100, 4s. 10d.	400 16 8	
10. RETIRING Allowance to Professor Stanfield, Consulting Engineer	150 0 0	
11. AIR RAID PRECAUTIONS	19 2 4	
12. MISCELLANEOUS Payments	247 12 9	
13. BALANCE of Expenses in connection with Edinburgh Show, 1939	176 12 0	
14. PREMIUMS and Medals for Local Shows and District Competitions	759 6 9	
15. CERTIFICATES and Medals for Long Service	58 19 1	
16. SPECIAL GRANTS—		
Animal Diseases Research Association, £200; Glasgow Veterinary College, £100; Scottish Agricultural Organisation Society, £100; Scottish Red Cross Agriculture Fund, £1600; other Grants, £87, 2s. 0d.	1,487 2 0	
17. INVESTMENT made—		
Cost of £10,000 3% War Loan, at par	10,000 0 0	
18. TEMPORARY Loans—Lodged		
£2,000 0 0		
Less uplifted	2,000 0 0	
	..	
19. ARREARS removed from Subscription List at 30th November 1940	80 3 6	
20. ARREARS of Subscriptions outstanding at 30th November 1940	443 10 6	
21. BALANCES at 30th November 1940—		
On Account Current with Royal Bank of Scotland—		
Edinburgh Account	£569 4 7	
London Account	17 0 0	
	£586 4 7	
In hands of Secretary	18 16 7	
	605 1 2	
SUM OF DISCHARGE	£20,665 19 10	

Society of Scotland, I beg to report that I have examined the Books and Accounts correctly stated and sufficiently vouched and instructed. From the Books and of the Treasurer with the Funds of the Society for the year ending 30th November
GEO. JAMES GREGOR, C.A.

HOME, Treasurer.

F. J. CARRUTHERS, Hon. Secretary.

ABSTRACT of the ACCOUNTS of the

CHARGE.

I. FUNDS at 30th November 1939—		
£3,193 London and North-Eastern Railway Company 3 per cent Debenture Stock	£2,650	0 0
£5,551, 16s. 3d. 3½ per cent Conversion Stock	4,216	18 2
£500 Queensland 3½ per cent Inscribed Stock, 1950-70	450	1 0
£412 London Midland and Scottish Railway Company 4 per cent Debenture Stock	611	10 6
£190 London Midland and Scottish Railway Company 4 per cent Guaranteed Stock	259	1 11
	£8,187	11 7
BALANCES with Royal Bank of Scotland—		
On Account Current	£238	8 7
On Deposit Receipt	410	15 3
		649 3 10
	£8,836	15 5
II. INTEREST ON INVESTMENTS—		
On £3,193 London and North-Eastern Railway Company 3 per cent Debenture Stock, for year to 30th June 1940	£95	15 10
Less tax	38	6 4
	£57	9 6
On £5,551, 16s. 3d. 3½ per cent Conversion Stock, for year to 1st October 1940	£194	6 2
Less tax	82	11 6
	111	14 8
On £500 Queensland 3½ per cent Inscribed Stock, 1950-70, for year to 1st July 1940	£17	10 0
Less tax	6	19 11
	10	10 1
On £412 London Midland and Scottish Rail- way Company 4 per cent Debenture Stock, for year to 30th June 1940	£16	9 6
Less tax	6	11 11
	9	17 7
On £190 London Midland and Scottish Rail- way Company 4 per cent Guaranteed Stock, for year to 30th June 1940	£7	12 0
Less tax	3	4 8
	4	7 4
		193 19 2
III. INTEREST ON DEPOSIT RECEIPTS		4 2 1
IV. INCOME TAX repaid for year to 5th April 1940		116 1 7
SUM OF CHARGE	£9,150	18 3

ARGYLL NAVAL FUND for the Year 1939-1940.**DISCHARGE.****I. ALLOWANCES to nine Recipients as follows :—**

9 at £40 each	£360 0 0
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II. FUNDS at 30th November 1940—

£3,198 London and North-Eastern Railway Company 3 per cent Debenture Stock	.	£2,650 0 0
---	---	------------

£5,551, 16s. 3d. 3½ per cent Conversion Stock	.	4,216 18 2
---	---	------------

£500 Queensland 3½ per cent Inscribed Stock, 1950-70	.	450 1 0
---	---	---------

£412 London Midland and Scottish Railway Company 4 per cent Debenture Stock	.	611 10 6
--	---	----------

£190 London Midland and Scottish Railway Company 4 per cent Guaranteed Stock	.	259 1 11
---	---	----------

£8,187 11 7

Note —The above Funds are entered at cost price. The market value at 30th November 1940 was £8,971, 3s. 0d

Balances with Royal Bank of Scotland—

On Account Current	.	£188 9 4	
On Deposit Receipt	.	414 17 4	
		<hr/>	603 6 8
			<hr/> 8,790 18 3

SUM OF DISCHARGE	.	£9,150 18 3
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HOME, *Treasurer.*
F. J. CARRUTHERS, *Hon. Secretary.*
GEO. JAMES GREGOR, C.A., *Auditor.*

VIEW OF RECEIPTS AND PAYMENTS for Year 1939-1940.**RECEIPTS.**

INTEREST AND DIVIDENDS	£4,054 15 9
INCOME TAX REPAID for year to 5th April 1940	1,845 2 3
	£5,899 18 0
ANNUAL SUBSCRIPTIONS AND ARREARS received	1,896 0 0
	£7,795 18 0

PAYMENTS.

ESTABLISHMENT EXPENSES (see page 213)	£3,960 16 1
FEE TO AUDITOR for 1938-1939	120 0 0
CHEMICAL DEPARTMENT	245 19 9
VETERINARY DEPARTMENT	24 1 0
EDUCATION	332 13 4
RETIRING ALLOWANCE TO CONSULTING ENGINEER	150 0 0
SOCIETY'S 'TRANSACTIONS'	1,446 17 4
ORDINARY Printing, Stationery, Advertising, and Miscellaneous Accounts	626 17 7
GRANTS TO LOCAL SOCIETIES, &c.	818 5 10
	<hr/>
	£7,725 10 11

Extraordinary Expenditure—

Special Grants (see page 213)	1,487 2 0	
		<hr/>
		9,212 12 11
DEFICIT		£1,416 14 11

Extraordinary Income—

Life Subscriptions	460 19 0
EXCESS OF PAYMENTS	£955 15 11

HOME, *Treasurer.*
 F. J. CARRUTHERS, *Hon. Secretary.*
 GEO. JAMES GREGOR, *C.A., Auditor.*

EDINBURGH, 8th January 1941.

PROCEEDINGS AT BOARD MEETINGS.

MEETING OF DIRECTORS, 3RD APRIL 1940.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—*Ordinary Directors*—Mr R. Scott Aiton; Mr J. W. Alexander, M.V.O.; Mr John D. Allan; Mr William Brown; Mr Alexander Clark; Mr James Clark; Mr Peter W. Crawford; Mr William I. Elliot; Mr Peter Gordon; Mr George Grant; Mr R. Wemyss Honeyman; Mr James Hope; Mr J. E. Kerr; Mr John Kerr; Mr James Kilpatrick; Mr Thomas M'Lay; Mr A. W. Montgomerie; Mr William Montgomery; Mr Robert Park; Sir Joshua Ross-Taylor; The Hon. Walter T. H. Scott, Master of Polwarth; Major Sir Samuel Strang Steel, Bt. *Extraordinary Directors*—Major R. F. Brebner; Mr Alexander Murdoch; Mr James Paton; Mr T. Mercer Sharp; Major Robert W. Sharpe; Mr Thomas Templeton. *Treasurer*—The Earl of Home, K.T. *Honorary Secretary*—Colonel F. J. Carruthers of Dormont. *Chemist*—Mr J. F. Tocher, D.Sc., LL.D., F.I.C.

The late Sir John Gilmour, Bt., of Montrave.

Before proceeding with the business of the Meeting, the Chairman said it was with very deep regret that he had to refer to the sudden death, on 30th March, of Sir John Gilmour, Bt., of Montrave, Minister of Shipping under H.M. Government.

Sir John, he said, had a long and close association with the Society, having been a member for over forty years, a Director from 1908 to 1915, and a Vice-President during the year of the Dundee Show, 1933. In 1934, on the occasion of the 150th anniversary of the foundation of the Society, he was elected an Honorary Member in recognition of his long and notable services to Agriculture and to the Country.

The extent of these services might be judged from the fact that, in the course of his political career, he was entrusted with the control of four great Departments of State, as Secretary of State for Scotland, Minister of Agriculture and Fisheries, Secretary of State for Home Affairs, and Minister of Shipping. In all these positions he rendered most valuable and devoted service to the Country.

It is a great pleasure to have Sir John's name read at this distinguished gathering.

by his appointment as Lord High Commissioner to the General Assembly in 1938. With all his other activities he retained a deep interest in Agriculture, more especially in Stock-breeding, and was a frequent and successful Exhibitor at the leading Stock Shows.

Personally, he was held in universal respect, and he was widely esteemed both in Scotland and farther South for his high sense of duty and his unswerving faith in the traditions and the future of the Country which he served. His untimely death was a loss to the Country and to the Society which they deeply deplored.

A Minute of regret and sympathy was submitted and adopted, the Members present upstanding, and the Secretary was instructed to forward a copy to Lady Gilmour and the family of the deceased.

Importation Licences for Farm Tractors.

The Secretary reported that, as instructed at the Meeting on 7th February, he had written to the Board of Trade with regard to the issue of Import Licences for Ford-Ferguson Tractors and Implements for Scotland. In a reply, dated

17th February, the Board stated that the Import Licensing Department were advised by the Ministry of Agriculture and Fisheries on questions affecting the issue of Import Licences for such tractors. There were special considerations of dollar exchange applying in the case of the applications for tractors for Northern Ireland which did not apply to the applications received for licences for tractors for Scotland. The matter was, however, receiving the attention of H.M. Treasury and the Ministry of Agriculture and Fisheries, and an assurance was given that the considerations set out in the Society's letter would not be overlooked. It was, however, pointed out that, in view of the urgent need for conserving foreign exchange, any proved advantages of the Ford-Ferguson Tractor might not be sufficient to justify the importation of these tractors from abroad.

Proctor's Tripod Harvesting System.

Mr R. Scott Aiton, Legerwood, Earlston, again directed attention to the Proctor Tripod Harvesting System, and said that, when previously discussed on 7th February, it was felt that the matter should be delayed until a later meeting, when there would be a larger attendance of members. Since the date of Mr Dale's letter, 23rd October 1939, there had been an awakening of interest amongst farmers in Scotland with regard to this method of haymaking and harvesting of corn. They were all disturbed and anxious as to how and from what source they were to get their concentrated feeding-stuffs for next winter. This system of making hay was undoubtedly a source from which they could obtain these much-needed proteins. By this system they could prevent the great loss from which they suffered in Scotland practically every year. Although it had been found impossible to obtain a supply of metal, Mr Proctor was now in a position to supply wooden tripods made from split chestnut.

A general discussion followed, when various proposals were submitted. These included a proposal that the matter be remitted to a Committee for further consideration, and a suggestion that the Society approach the Department of Agriculture for Scotland with a view to obtaining a grant to assist Mr Proctor in placing his invention on the market.

The Chairman said he did not think it was possible for them to approach the Department of Agriculture. He did not think it was the function of the Society to assist any commercial undertaking. The discussion which had taken place would serve the purpose of giving publicity to the system, and he thought it would be wise that they should now let the matter drop.

This was agreed to.

Scottish Red Cross Agriculture Fund.

Minutes of Meetings of Special Committee, dated 21st February, 6th March, and 3rd April, were submitted and approved.

These Minutes stated that, in accordance with the remit from the Board on 7th February, the Committee had taken into consideration the question of taking action on the invitation of the Scottish Branch, British Red Cross Society, towards setting up a Committee in Scotland to organise the raising of funds from the Agricultural interests. After full consideration and discussion, it had been decided that the Society should take the initiative in forming such a Committee. It was further decided that the first step should be the convening of a meeting of representatives of National bodies in Scotland connected with Agriculture. A list of such bodies had been prepared, and the form of letter of invitation to be sent to them adjusted. The date proposed for this representative meeting was 17th April.

An application had been received from the St Andrew's Ambulance Association to be allowed to participate in the Fund. It was pointed out that this would place the St Andrew's Association in the same position in relation to the Fund in Scotland as that occupied by the St John Ambulance Association in England. The Scottish Branch of the British Red Cross Society were prepared to accede to this request, and the Committee recommended that this be agreed to. The allocation between the two bodies, of the funds raised, would be left to a small Committee.

The Chairman, in moving approval of the Minutes and of the action taken by the Special Committee, said he was sure that all Agriculturists would most heartily support the scheme. They would require to call upon the Directors in the various Show Divisions to lend their help, along with representatives of the National Farmers' Union and Chamber of Agriculture, Local Agricultural Societies, and particularly the Auctioneers, in promoting Free Gift Sales and other activities.

Several Societies had agreed to give grants from their funds, or to assist in promoting schemes for the raising of money, and they hoped to co-ordinate these efforts into one big effort on behalf of the Red Cross Fund which would be worthy of their country.

Wool Prices.

The following Report on a Conference held at the Offices of the National Farmers' Union and Chamber of Agriculture on 20th March, with regard to the prices for the 1940 Wool Clip, was submitted :—

"On 14th March a letter was received from the National Farmers' Union and Chamber of Agriculture, in which it was mentioned that the Minister of Supply, when asked in December last to receive a deputation on the question of Wool Prices, gave a promise that he would discuss the terms on which, if War conditions continued, the Clip for 1940 would be taken over, and that he would ask representatives of the farmers to meet him and his colleagues on the subject. The N.F.U. and Chamber considered it most important that negotiations for the adjustment of prices for the 1940 Clip should be commenced now, and they had asked the Minister of Supply to arrange for a Meeting at the earliest possible date. The War Committee of the Union and Chamber considered it very desirable, in view of impending consultations, that there should be opportunity for a full review of the position, and that it would be advantageous to the representatives who were to meet the Minister if they were fully aware of the prices which the Societies interested had in mind. They, therefore, invited the Society to appoint representatives to attend a Conference on Wednesday, 20th March.

"The Society was represented at the Conference by the Chairman of Directors, Major B. F. Brebner, and Sir Joshua Ross-Taylor. Other bodies represented were the Scottish Land and Property Federation, the Blackface, Cheviot, Border Leicester, Suffolk, and Oxford Down Sheep Societies, and the Northern Pastoral Club.

"A full discussion took place with regard to the prices which should obtain for the 1940 Wool Clip, and a representative deputation was appointed to meet the Minister of Supply, at such time as he should appoint, to discuss the matter.

"The members of the deputation were as follows : Captain Thomas Elliot, Captain James Craig, Mr William Graham, Mr William I. Elliot, Mr Ian M. Campbell, Lochiel, and Sir Joshua Ross-Taylor."

Inspection of Growing Crops of Potatoes.

A letter was submitted from the Department of Agriculture for Scotland, inviting the Society to appoint representatives to attend a Conference on 4th April to discuss the operation of the Department's scheme for the inspection of growing crops of potatoes during the past season. The Department asked to be furnished, before the Meeting, with a note of any particular points which the Society might wish to discuss.

The Secretary reported that he had communicated with Mr James Paton, Kirkness, Glencraig, who represented the Society along with the late Mr Cowper at previous Conferences, and asked if he had any suggestions which should be forwarded to the Department. Mr Paton made certain suggestions, which were duly communicated to the Department.

It was agreed that the Society's representatives at the Conference be Mr James Paton and Mr James Hope, Eastbarns, Dunbar.

Animal Diseases Research Association.

An application was submitted from the Animal Diseases Research Association for renewal of the grant of £200 for the current year.

On the recommendation of the Finance Committee, it was agreed that the grant be renewed.

Glasgow Veterinary College.

An application for a renewal of the grant of £100 for the current year to the Glasgow Veterinary College was submitted, and it was decided, on the recommendation of the Finance Committee, that the grant be renewed.

Next Board Meeting.

It was left to the Chairman and Secretary to decide as to the calling of a Meeting in May, it being understood that no Meeting should be called unless business of sufficient importance should arise to render a Meeting necessary.

SPECIAL MEETING OF DIRECTORS, 5TH JUNE 1940.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—Ordinary Directors—Mr R. Scott Aiton; Mr J. W. Alexander, M.V.O.; Mr David Blair; Mr Alexander Forbes; Mr Peter Gordon; Mr George Grant; Mr R. Wemyss Honeyman; Mr J. E. Kerr; Mr James M'Laren; Mr A. W. Montgomerie; Mr William Montgomery; Mr Robert Park; Sir Joshua Ross-Taylor; Major Sir Samuel Strang Steel, Bt. *Extraordinary Directors*—Major R. F. Brebner; Mr James R. Lumsden; Mr Duncan A. MacLennan; Mr Alexander Murdoch; Mr James Paton; Mr T. Mercer Sharp; Major Robert W. Sharpe; Mr John P. Sleigh; Mr James Wither. *Treasurer*—The Earl of Home, K.T. *Auditor*—Mr George James Gregor, C.A.

Scottish Red Cross Agriculture Fund.

The Chairman explained the reason for calling that Meeting. Any grant to be given to the Red Cross Agriculture Fund would require to be approved at two Meetings of Directors and adopted at a General Meeting. If this procedure were followed, in the ordinary course no grant could be given until the General Meeting in January. In view of the great demands on the Red Cross at the present time, it was felt that any grant which might be given should be given at once.

To get over this difficulty, it was suggested that two Meetings of the Board of Directors be held on one day, and the opinion of the Society's Law Agents had been obtained to the effect that such a procedure would be perfectly in order in accordance with the terms of the Charter. If a grant were approved at that Meeting, it could be confirmed at the subsequent Meeting that day, and submitted for adoption at the General Meeting which followed.

The Chairman then moved that a grant of £1000 be given to the Scottish Red Cross Agriculture Fund.

The Motion was seconded by the Earl of Home, K.T., Treasurer, and unanimously agreed to.

MEETING OF DIRECTORS, 5TH JUNE 1940.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—Ordinary Directors—Mr R. Scott Aiton; Mr J. W. Alexander, M.V.O.; Mr David Blair; Mr Alexander Forbes; Mr Peter Gordon; Mr George Grant; Mr R. Wemyss Honeyman; Mr J. E. Kerr; Mr James M'Laren; Mr A. W. Montgomerie; Mr William Montgomery; Mr Robert Park; Sir Joshua Ross-Taylor; Major Sir Samuel Strang Steel, Bt. *Extraordinary Directors*—Major R. F. Brebner; Mr James R. Lumsden; Mr Duncan A. MacLennan; Mr Alexander Murdoch; Mr James Paton; Mr T. Mercer Sharp; Major Robert W. Sharpe; Mr John P. Sleigh; Mr James Wither. *Treasurer*—The Earl of Home, K.T. *Chemist*—Mr J. F. Tocher, D.Sc., LL.D., F.I.C.

The late Sir Henry Alexander, Aberdeen.

Before proceeding with the business of the Meeting, the Chairman said it was with very deep regret that he had to refer to the death of Sir Henry Alexander, Aberdeen. Sir Henry was a Life Member of the Society. He was Lord Provost of Aberdeen, and a Vice-President of the Society, on the occasion of the last Show in that city in 1935. In that capacity he was untiring in his efforts to promote the success of the Show. His sincerity of purpose and kindly disposition earned for him the regard and esteem of all connected with the Society, both Directors and Officials, with whom he came in contact.

While they recalled with gratitude his activities in connection with the affairs of the Society, it only needed to be mentioned that in other and varied spheres of public work he rendered valuable services to the community.

He moved that they record in the Minutes an expression of appreciation of the valuable services rendered by Sir Henry Alexander to the Society, and that a letter of regret and sympathy be forwarded to Lady Alexander and the family of the deceased.

The Motion was unanimously adopted, the members present upstanding.

The late Mr William H. Buist, O.B.E., Dundee.

The Chairman also referred with very deep regret to the death of Mr William H. Buist, O.B.E., who was Lord Provost of Dundee, and a Vice-President of the Society, on the occasion of the successful Show held there in 1933. It was not too much to say, he said, that the success of the Show was in great measure due to the influence and exertions of Lord Provost Buist. There was no detail in connection with the Show which was too small to receive his personal attention, and his ready help and cheerful disposition gave pleasure to all who had the privilege of meeting and working with him.

Apart from this, Lord Provost Buist did much public work, and occupied many responsible positions, in all of which he rendered valuable services to the community.

He moved that they record in the Minutes an expression of appreciation of the valuable services rendered by Lord Provost Buist to the Society, and that a letter of regret and sympathy be forwarded to the widow of the deceased.

The Motion was unanimously adopted, the members present upstanding.

Letters.

The following letters were submitted :—

Lady Gilmour, Montrave.—Expressing thanks for resolution of regret and sympathy on the death of her husband, the late Sir John Gilmour, Bt.

Royal Lancashire Agricultural Society.—Intimating offer of prizes for Essays dealing with the Economical Production of Food in War-time.

Scottish Red Cross Agriculture Fund.

A Report on the Proceedings at a Meeting of National bodies connected with Agriculture and Allied Industries, held in Edinburgh on 17th April, was submitted. A copy of this Report had been circulated to Members of the Board.

A summary of this Report, and subsequent proceedings, appears in the Minute of the Half-yearly General Meeting held on 5th June 1940.

The decision arrived at by the Directors at a Special Meeting held that day, that a grant of £1000 be given to the Scottish Red Cross Agriculture Fund, was, on the motion of the Chairman, unanimously confirmed.

Basic Prices for Cattle and Sheep.

A letter was submitted from the National Farmers' Union and Chamber of Agriculture of Scotland, dated 24th April, forwarding a Statement in support of their claim for increased basic prices for Cattle and Sheep.

A further letter, dated 16th May, was submitted, forwarding Memorandum regarding Sheep Production in Scotland, and Statement in support of their claim for an increase in Wool Prices for the 1940 Clip.

The Chairman said that, in view of a recent pronouncement by the Minister of Agriculture, it did not appear that this was a matter in which they could usefully intervene at that time, and this was agreed to.

Inspection of Growing Crops of Potatoes.

A Report was submitted by Mr James Hope, Eastbarns, on the proceedings at a Conference held at the Offices of the Department of Agriculture on 4th April. From this report it appeared that the suggestions for modifications in the regulations, submitted by the Society's representatives, had, in the main, been adopted.

It was agreed to thank Mr Hope for his attendance as representing the Society, and for the report which he had submitted.

Animal Diseases Research Association.

On the motion of the Earl of Home, K.T., Treasurer, it was unanimously agreed to confirm the proposed grant of £200 for the current year to the Animal Diseases Research Association.

Glasgow Veterinary College.

On the motion of the Earl of Home, K.T., it was unanimously agreed to confirm the proposed grant of £100 for the current year to the Glasgow Veterinary College.

Finance.

A Minute of Meeting of Committee, dated 5th June, was submitted and approved.

The Minute dealt, *inter alia*, with the following matter :—

Edinburgh Highland Reel and Strathspey Society.—It was recommended that a grant of £50 be given for the current year, together with an additional grant of £25, in view of the fact that, on account of War conditions, the Reel and Strathspey Society was unable to hold its Annual Concert, and thereby had suffered a loss of revenue.

MEETING OF DIRECTORS, 6TH NOVEMBER 1940.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—*Ordinary Directors*—Mr R. Scott Aiton; Major R. F. Brebner; Major A. D. Campbell; Mr Alexander Clark; Mr Peter Gordon; Mr George Grant; Mr James Hope; Mr James R. Lumsden; Mr Finlay MacGillivray; Mr Thomas M'Leay; Mr Alexander Murdoch; Mr Robert Park; Mr James Paton; Mr G. H. Russell; Major Sir Samuel Strang Steel, Bt.; Mr Thomas Templeton. *Extraordinary Directors*—Mr William I. Elliot; Mr J. E. Kerr; Mr William Montgomery; Sir Joshua Ross-Taylor; Mr T. Mercer Sharp; Major Robert W. Sharpe; Mr John P. Sleight; Mr James Withers. *Treasurer*—The Earl of Home, K.T. *Honorary Secretary*—Colonel F. J. Carruthers of Dormont. *Chemist*—Mr J. F. Tocher, D.Sc., LL.D., F.I.C.

Chairman of the Board for 1940-41.

On the motion of Sir Joshua Ross-Taylor, Mungoswalls, Duns, Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh, was unanimously re-elected Chairman of the Board for the ensuing year.

Major Brebner, in accepting office, thanked the Directors for the honour they had done him in re-electing him Chairman of the Board, and said that, apart from the work connected with the Red Cross Agriculture Fund, his duties as Chairman during the past year had been extremely light.

Letters.

The following letters were submitted :—

The Duke of Portland.—Expressing thanks for his re-election as President of the Society for the year 1940-41.

Lady Alexander, Aberdeen.—Thanking the Directors for resolution of sympathy on the death of her husband, the late Sir Henry Alexander.

Mrs Buist, Dundee.—Expressing thanks for resolution of sympathy on the death of her husband, the late Lord Provost William H. Buist.

Edinburgh Highland Reel and Strathspey Society.—Conveying thanks for renewal of grant of £50, and additional grant of £25, for the current year.

Scottish Red Cross Agriculture Fund.

The Chairman gave a short report on the activities of the Scottish Red Cross Agriculture Fund Committee. A Meeting of the Executive Committee of the Fund was to be held that afternoon, and he did not wish to anticipate anything that Lord Home might desire to say at that Meeting.

At the moment, they had received £25,269, 19s. 1d., and there was a good deal of money still to come in. He thought this result dispelled the fear expressed when the Fund was started that there might be overlapping with other War efforts.

Major Brebner said he would like to express to his fellow-Directors the thanks of the Committee for the great help they gave in connection with the setting up of Area Committees throughout Scotland. Everywhere the Committee had

met with enthusiastic support, and they also received great support from the Auctioneers, without whom it would have been impossible to hold Free Gift Sales. He appealed to the Area Committees to keep themselves in being, so as to be prepared for a fresh effort in 1941. They all realised how necessary it was that they should raise as much money as possible for the Red Cross Fund, particularly in view of the large number of War Prisoners belonging to Scotland.

The Earl of Home, K.T., Chairman of the Committee, said he would like to support what Major Brebner had said, and to express his grateful thanks to all who had worked so hard to make the Fund such a great success. The Directors had given great help in forming the Area Committees throughout Scotland.

'Transactions.'

A Minute of Meeting of Publications Committee, dated 6th November, was read and approved.

The Minute recommended that, provided the printers were able to secure a Licence for the necessary paper, a restricted volume be published in 1941. This volume would include such regular features as the Proceedings, Crop Reports, Milk Records, Accounts, Establishment, &c., and a few articles of special interest under present conditions, these latter not to exceed 100 pages.

National Museum of Wales, Cardiff.

The Secretary reported that, in September, he had received, through Dr Tocher, a request from Mr Colin Matheson, M.A., B.Sc., Keeper of the Department of Zoology, National Museum of Wales, Cardiff, for photographs of Scottish Breeds of Farm Live Stock. These were wanted in connection with a Special Exhibition of British Breeds of Domestic Animals which he was arranging, and which was to last for a period of six months.

After consultation with the Chairman of Directors, the Secretary had communicated with the various Scottish Breed Societies, and, through them, had arranged for suitable photographs to be sent to Mr Matheson. A letter from him was read, in which he expressed thanks for the trouble which had been taken to procure the photographs.

The Meeting approved of the action which had been taken.

Date of next Meeting.

It was agreed that it be left to the Chairman and Secretary to decide as to whether there was business of sufficient importance to necessitate the calling of a Meeting of the Board in December. In the event of no Meeting being held, authority was given to pay the Grants to Local Societies, which normally fell to be made during that month.

Finance.

A Minute of Meeting of Committee, dated 6th November, was submitted and approved.

The Minute dealt with the following matters:—

Members' Subscriptions.—The Secretary reported that, as a result of War conditions, there appeared to be a falling off in receipts from members' annual subscriptions of a sum of approximately £500. There was also a falling off in receipts from life subscriptions of a similar amount. He also submitted figures giving an estimate of income and expenditure for the ensuing year, from which it appeared that, if no new special grants were given and the expenditure on the 'Transactions' was restricted to £1200, the income from investments and subscriptions would be sufficient to meet the expenditure.

Chief Clerk on Military Service.—It was reported that Mr T. W. Russell, Chief Clerk, had been called up for military service at the end of October, and was now with a Searchlight Training Regiment (R.A.), at Taunton, Somerset.

Scottish Agricultural Organisation Society, Ltd.—It was recommended that the grant of £100 to the Scottish Agricultural Organisation Society be again renewed for the year 1941.

Catalogue of Society's Library.—It was resolved that the Catalogue, which was submitted in proof, and extended to 590 pages, be now printed off—1000 copies to be printed; 200 of these to be bound in the first instance; and the price of the Catalogue to be 2s. 6d.

Income Tax Deductions from Salaries.—The Secretary submitted notification he had received from the Income Tax Authorities of income tax to be deducted each month from salaries and wages.

MEETING OF DIRECTORS, 8TH JANUARY 1941.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—Ordinary Directors—Mr R. Scott Aiton ; Mr J. W. Alexander, M.V.O. ; Major R. F. Brebner ; Mr Peter Gordon ; Mr George Grant ; Mr John Kerr ; Mr James Paton ; Hon. Walter T. H. Scott, Master of Polwarth ; Major Sir Samuel Strang Steel, Bt. *Extraordinary Directors*—Mr William I. Elliot ; Mr J. E. Kerr ; Mr William Montgomery ; Sir Joshua Ross-Taylor ; Mr T. Mercer Sharp. *Treasurer*—The Earl of Home, K.T. *Honorary Secretary*—Colonel F. J. Carruthers of Dormont. *Chemist*—Mr J. F. Tocher, D.Sc., LL.D., F.I.C.

The late Mr John D. Allan, Culthill.

Before proceeding with the business of the Meeting, the Chairman referred, with deep regret, to the death, since last Meeting, of a member of the Board, Mr John D. Allan, formerly of Culthill Implement Works, Murthly. Mr Allan, he said, was a member of the Society for nearly thirty years. During the past four years he was an Ordinary Director, and prior to that for two years an Extraordinary Director representing the Implement trade.

Mr Allan took a keen interest in the affairs of the Society, and was regular in his attendance at the Board Meetings. His firm of J. D. Allan & Sons were constant exhibitors at the Highland Shows, being one of the oldest standholders. The firm were noted as makers of a variety of farm implements, all esteemed for sound workmanship and practical utility.

Besides his engineering and implement-making business, Mr Allan was an enthusiastic farmer, with a special interest in the rearing of high-grade cattle. His technical skill and wide knowledge of agricultural affairs, combined with his frank and genial disposition, made him known and esteemed by a wide circle of friends, by whom his well-known personality would be missed at Agricultural events throughout the country.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy thereof to the widow and family of the deceased.

The late Mr George Buchanan, Hunterhill, Paisley.

The Chairman also referred, with deep regret, to the death of Mr George Buchanan, Hunterhill, Paisley. Bailie Buchanan, as he was generally known by his contemporaries, was, he said, a member of the Society for thirty-five years, and served as an Ordinary Director for a term of four years from 1932 to 1936.

While taking a practical interest in the work of the Society, regarding which he was at times inclined to be frankly critical, he devoted much time and energy to the business of other Agricultural organisations. He was an original member and Past-President of the National Farmers' Union of Scotland, and an active member of the Scottish Milk Marketing Board from the date of its inception up till his death. He was also closely identified with the work of the Scottish Milk Agency, the voluntary association of milk producers which preceded the Marketing Board.

Bailie Buchanan carried on business as a milk producer and milk distributor on a large scale in his native town of Paisley, and, in addition, found time to take a prominent part in the municipal affairs of the town. He was widely recognised as an authority on British Friesian Cattle.

His enthusiasm and devotion to the work of every cause in which he was interested, in the service of which he never spared himself, combined with his kindly disposition, made him known and esteemed by a wide circle of friends, to whom his passing had come as a sad loss.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy thereof to the family of the deceased.

* *Letter.*

The following letter was submitted :—

The Duke of Portland, K.G., President of the Society.—Expressing regret at inability to attend and preside at Anniversary General Meeting, and asking to be informed of anything he could do to forward the interests of the Society at any time.

Finance.

A Minute of Meeting of Finance Committee, dated 8th January, was read and approved.

The Minute stated that the Accounts for the year 1939-40, as prepared by the Society's Auditor, had been submitted and approved, and signed by two members of the Finance Committee and by the Auditor.

Scottish Red Cross Agriculture Fund.

The Chairman reported that the total contributions received by the Fund up to that date was £82,176, 12s. 6d. The proceeds of a number of Free Gift Sales had yet to be received. The activities of the Committee would be reported upon in more detail at the Annual General Meeting that afternoon.

Inspection of Growing Crops of Potatoes.

The Secretary reported that an invitation had been received from the Department of Agriculture for Scotland to appoint representatives to attend a Meeting to be held on 12th December 1940 to discuss the operation of the Scheme for the Inspection of Growing Crops of Potatoes during the past season, and any suggestions that might be offered for the amendment of the Scheme in 1941. Mr James Paton, Kirkness, Glencairn, and Mr James Hope, Eastbarns, Dunbar, had attended the Meeting as representing the Society.

Mr Paton reported on the proceedings at the Meeting, and said that general satisfaction was expressed with the conditions governing the issuing of Certificates for the crops grown in 1940, and it was unanimously agreed that no change should be made during 1941. He gave figures regarding three of the main seed varieties to show how beneficial to growers had been the proposals put forward last year on behalf of the Society.

Scottish Agricultural Organisation Society.

On the motion of the Earl of Home, K.T., Treasurer, it was unanimously agreed to confirm the proposed grant of £100 to the Scottish Agricultural Organisation Society for the year 1941.

Grants to Local Societies.

A Report by the Shows Committee, dated 8th January, relating to Grants to Local Societies, was submitted and approved.

The Secretary stated that the Report contained an important decision which had been arrived at by the Committee, and which affected materially the amount of money to be offered during the ensuing year. It was in the following terms:—

"It was unanimously agreed that it was undesirable for the Society to encourage the holding of Agricultural Shows during the War, and it was accordingly unanimously decided to recommend that all Grants by the Society, of money and medals, in aid of Local Agricultural Shows, be suspended throughout the duration of the War."

An application was submitted from the Scottish Association of Young Farmers' Clubs for Medals for Ploughing Competitions for members of the Clubs and members of the Women's Land Army. It was proposed that there should be a class for each Section, and a Championship Class in which both Sections would compete.

It was decided that the Society offer Medals for the Competitions, the number and nature of these to be left to the Chairman and Secretary.

Future of Agriculture.

The Chairman said that he had been considering for some time what action the Society could take with regard to a post-war Policy for Agriculture in Scotland. He felt that the Society, in view of its size and independent position, and the fact that every interest connected with Agriculture was represented in its membership, was well qualified to undertake an inquiry of this nature. The first step would probably be to appoint a representative Committee to discuss what action should be taken by the Society towards the consideration of post-war Agricultural conditions in Scotland.

After some discussion, the Chairman intimated that he would raise the matter at next Meeting of the Board.

PROCEEDINGS AT GENERAL MEETINGS.

GENERAL MEETING, 5TH JUNE 1940.

THE EARL OF HOME, K.T., Treasurer of the Society, in the Chair.

New Members.

The Secretary submitted a list of eleven candidates for election to membership. These were balloted for and duly elected.

Election of Office-Bearers.

The following noblemen and gentlemen were elected office-bearers of the Society for the year 1940-41 :—

President.—The Duke of Portland K.G., P.C., G.C.V.O., Langwell, Berriedale, Caithness.

Vice-Presidents.—The Duke of Sutherland, K.T., P.C., Dunrobin Castle, Golspie ; The Earl of Leven and Melville, Glenferness House, Nairn ; Sir Donald W. Cameron of Lochiel, K.T., Achnacarry, Spean Bridge, Inverness-shire ; Colonel the Hon. Evan Baillie, M.C., of Dochfour, Ballindarroch, Scaniport, Inverness.

Ordinary Directors, 1937.—Mr R. Wemyss Honeyman, Derculich, Strathtay, Perthshire ; Mr A. W. Montgomerie, Westburn Farm, Cambuslang, Lanarkshire ; Mr Alexander Forbes, Rettie, Banff ; Major Sir Samuel Straug Steel of Philiphaugh, Bt., Selkirk ; Mr James M'Laren, Corneton, Bridge of Allan ; Mr Peter W. Crawford, Dryfeholm, Lockerbie ; Mr John Kerr, Yorkston, Gorebridge, Midlothian ; Mr Ian M. Campbell, Bal Blair, Invershin.

1938.—Mr James Clark, Windlaw House, Carmunnock, Glasgow ; Mr James Durno, Crichtie, Inverurie ; Mr R. Scott Aiton, M.C., Legerwood, Earlstoun ; Mr T. G. Wilson, Carbeth Home Farm, Balfron Station ; Mr J. W. Alexander, M.V.O., of Newton, Golfhill, Moffat ; Mr Robert Park, Brunstane, Portobello, Midlothian ; Mr Finlay MacGillivray of Aldie, Tain ; Mr David Blair, Littleinch, Wormit.

1939.—Mr George Grant of Glenfarclas, Blackboat ; The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick ; Mr Thomas M'Lay, Dunvegan, Causewayhead, Stirling ; Mr Peter Gordon, Balcarraig Moor, Port William ; Mr James Hope, Eastbarns, Dunbar ; Captain Ian S. Robertson, Linkwood, Elgin ; Mr Alexander Clark, Strathore House, Thornton ; Mr James Kilpatrick, Craigie Mains, Kilmarnock.

1940.—Mr Thomas Templeton, Sandyknowe, Kelso ; Mr James R. Lumsden of Arden, Dumbartonshire ; Mr J. Faed Sproat, Boreland of Anwoth, Gatehouse, Castle-Douglas ; Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh ; Major A. D. Campbell, Stanstill, Wick ; Mr James Paton, Kirkness, Glencraig ; Mr Alexander Murdoch, East Hallsido, Cambuslang, Lanarkshire ; Mr G. H. Russell of The Burn, Glenesk, Brechin.

Extraordinary Directors.—Mr T. Mercer Sharp, Bardrill, Blackford ; Major R. W. Sharpe of The Park, Earlstoun ; Mr John P. Sleight of St John's Wells, Fyvie ; Mr A. A. Hagart Speirs of Elderslie, Houston House, Renfrewshire ; Mr James Wither, Awhirk, Stranraer ; Mr John D. Allan, Culthill Implement Works, Murthly ; Mr William I. Elliot, Middletoun, Stow ; Mr J. E. Kerr of Harviestoun,

Dollar; Mr William Montgomery, North Milton, Kirkeudbright; Sir Joshua Ross-Taylor, Mungoswalls, Duns.

Show District.—Mr James H. Fraser, Easter Lovat, Beauly; Lieut.-Colonel M. J. Grant-Peterkin of Grange, Grange Hall, Forres; Mr James MacKessack Leitch, Carden, Alves, Forres; Mr Kenneth P. MacGillivray, Kirkton, Bunchrew, Inverness; Provost Hugh Mackenzie, Inverness; Mr D. A. MacLennan, Balma-chree, Inverness; Mr Ralph S. MacWilliam, Garguston, Muir of Ord; Major Gideon C. Rutherford, Proney, Dornoch; Major John Stirling of Fairburn, Muir of Ord; Mr Francis W. Walker of Leys, Leys Castle, Inverness.

Treasurer.—The Earl of Home, K.T., The Hirsel, Coldstream.

Honorary Secretary.—Colonel F. J. Carruthers of Dormont, Lockerbie.

Special Grants.

The Earl of Home, K.T., Treasurer of the Society, moved approval of the following Special Grants which were recommended by the Board of Directors:—

- (1) £200 for the current year to the Animal Diseases Research Association.
- (2) £100 for the current year to the Glasgow Veterinary College.
- (3) £50 for the current year to the Edinburgh Highland Reel and Strathspey Society, plus £25 extra war contribution.
- (4) £1000 to the Scottish Red Cross Agriculture Fund.

Mr Alexander Murdoch, East Hallsido, Cambuslang, seconded, and the grants were approved.

Scottish Red Cross Agriculture Fund.

Major R. F. Brebner, Chairman of Directors, submitted a report on the Scottish Red Cross Agriculture Fund.

In February, he said, a letter was received from the Scottish Branch, British Red Cross Society, inviting the Highland and Agricultural Society to take the initiative in forming an Agriculture Committee for raising money on behalf of the Red Cross from the agricultural community and allied industries in Scotland. A Committee with that object had been formed in England under the name of the Red Cross Agriculture Fund Committee. The Directors agreed to accept the invitation, and to do their utmost to make the scheme a success.

An application was received from the St Andrew's Ambulance Association to be allowed to participate in the fund. It was pointed out that this would place the St Andrew's Association in the same position in relation to the fund in Scotland as that occupied by the St John Ambulance Association in England. This request was readily acceded to, both by the Directors and by the Scottish Branch of the British Red Cross Society.

On 17th April a Meeting was held in Edinburgh, at which were present representatives of national bodies connected with agriculture and allied industries. These bodies included the Department of Agriculture for Scotland, the National Farmers' Union and Chamber of Agriculture of Scotland, the Scottish Farm Servants' Union, the Institute of Auctioneers and Appraisers in Scotland, the Chartered Surveyors' Institution, the Scottish Land and Property Federation, the various Live Stock Breed Societies, the Corn, Meat, Potato, and Wool Trade Associations, Forestry and Horticultural Societies, the Scottish Association of Young Farmers' Clubs, the Scottish Beekeepers' Association, the International Sheep Dog Trials Society, the Scottish Agricultural Machinery Association, and the various Agricultural and Veterinary Colleges. There were also present representatives of the Scottish Branch, British Red Cross Society, and of the St Andrew's Ambulance Association.

At that Meeting it was resolved that the representatives of the organisations present constitute themselves the General Committee of the Scottish Red Cross Agriculture Fund, with power to add to their number, the object of the Committee being the raising of funds on behalf of the Red Cross and St Andrew's Ambulance Association from the agricultural interests in Scotland. The Earl of Home, K.T., was unanimously elected Chairman of the General Committee. Major R. F. Brebner, The Leuchold, Dalmeny, and Mr George G. Mercer, Southfield, Dalkeith, were elected Vice-Chairmen, and Mr John Stirling, Secretary of the Highland and Agricultural Society, was elected Honorary Secretary and Treasurer.

An Executive Committee of twenty-five members was appointed, and also a small Allocation Committee to decide as to the allocation, between the Scottish

Branch, British Red Cross and the St Andrew's Ambulance Association, of the funds raised by the Committee.

It was left to the Executive Committee to proceed with the establishment of Local Committees in the different areas throughout Scotland. It was thought that these areas might follow generally the lines of the Highland Society's Show Divisions. The Committees would include representatives of the Highland and Agricultural Society and of the National Farmers' Union and Chamber of Agriculture in each Division, together with representatives of all Agricultural Societies, Auctioneers, and other agricultural interests in the area.

Up to that date, one of these Area Meetings had been held—that for the Lothians or the Edinburgh Show Division. It was well attended by representatives of the Highland Society, National Farmers' Union and Chamber, Auctioneers, and Local Agricultural Societies. Consideration was given to the methods by which money could be raised for the fund, and it was agreed that Free Gift Sales of Live Stock, &c., would be likely to prove most productive. Such sales, however, could not take place until August or September.

It was agreed that, if possible, sales should be arranged at the following centres—Edinburgh, Dalkeith, Haddington, Bathgate, Linlithgow, and Sub-Committees were appointed to organise and carry through the arrangements for the sales at these centres. It was also remitted to these Sub-Committees to consider and carry through any other schemes for raising money for the fund within their districts.

It was hoped to arrange for similar Meetings in the other areas throughout the country at an early date.

Major Brebner added that when these arrangements were completed they might expect a very successful effort on behalf of the Red Cross. In the present circumstances in which they found themselves, the need for this fund was greater than it had been before. He was quite sure that the agricultural community would respond most readily and generously and so help the very effective work which the Red Cross Society were doing.

Mr J. Milne Henderson, C.A., Edinburgh, suggested that the attention of the public should be drawn to the fact that if they signed a bond to pay a certain sum to the Red Cross Society for a period of seven years or the duration of the war, whichever was shorter, that would result in income-tax being allowed off, and to those who paid super-tax it would be a very great advantage. It had been said that those who took advantage of such a scheme were unpatriotic, but how could they be unpatriotic in doing something which the Government allowed? Away back in 1922, when the large hospitals in England and Scotland were practically on their beam-ends, strong representations were made to the Government to give grants for the maintenance of infirmaries and other charitable institutions. A considerable number of people objected to that on the ground that it would kill private charity, and he agreed. Thereafter, on a strong representation to the then Chancellor of the Exchequer, Mr Churchill put into the Finance Budget a provision that whoever granted a bond for seven years or for the duration of his life, whichever was the shorter, income-tax would be allowed off. Probably the man who did most to obtain the concession was Sir Daniel Stevenson of Glasgow. He had no doubt if Major Brebner got in touch with the Glasgow people he would learn more about it.

The Chairman thanked Mr Milne Henderson for his remarks.

Agricultural Education.

Sir Joshua Ross-Taylor, Mungoswalls, Duns, reported on the 41st Examination for the National Diploma in Agriculture.

Owing to the interruption during the Autumn term of the normal courses of instruction at most English Agricultural Colleges, due to the war, the National Agricultural Examination Board decided to hold two Examinations in 1940, one at Edinburgh in April and the other at Leeds in July, so that candidates might be given an opportunity to appear at either, as they found suitable.

At the Examination held at Edinburgh on 3rd April and following days, 59 candidates presented themselves. 30 candidates were from Scottish centres. As a result of the Examination 26 Diplomas were awarded. Of the 59 candidates, 3 appeared for all subjects, and 1 obtained the Diploma. 29 had passed certain subjects previously and were completing the Examination that year, and of these 25 were successful in obtaining the Diploma. The remaining 27 presented themselves for groups of three, four, or five subjects, and of these, 18 passed in the subjects for which they appeared and were entitled to appear for the Second Group of Subjects at a subsequent Examination.

The results of the Examination to be held at Leeds in July would be intimated at a future Meeting.

*Science.**Report by Chemist.*

Dr J. F. Tocher, Consulting Chemist to the Society, submitted a Report on the work done in his department during the past six months. The substance of Dr Tocher's Report appears on pp. 127-133 of this volume.

Vote of Thanks.

On the motion of Mr James Paton, Kirkness, Glencairn, a vote of thanks was accorded to the Earl of Home for presiding.

ANNIVERSARY GENERAL MEETING, 8TH JANUARY 1941.

THE EARL OF HOME, K.T., Treasurer of the Society, in the Chair.

New Members.

Three candidates for election were balloted for and admitted members of the Society.

Finance.

The Earl of Home, K.T., Treasurer of the Society, submitted the Accounts of the Society for the year ending 30th November 1940.

In order to save expense, the Abstract of Accounts had not been issued to each member as previously. A short Abstract had been published in various papers, as required by the bye-laws.

The receipts for the year from all sources reached a total of £8256, 17s., and the payments amounted to £9212, 12s. 11d. Annual subscriptions amounted to £1898, and Life subscriptions to £460, 19s.

During the year expenditure on educational work amounted to £332, 13s. 4d.; on the work in the Chemical and Veterinary Departments, £270, 0s. 9d.; on the Society's 'Transactions,' £1446, 17s. 4d.; and Premiums and Medals for Local Shows and Competitions, &c., in 1939 amounted to £818, 5s. 10d. Special Grants were made during the year as follows: Scottish Red Cross Agriculture Fund, £1000; Animal Diseases Research Association, £200; Glasgow Veterinary College, £100; Scottish Agricultural Organisation Society, £100; other Grants, £87, 2s.--a total of £1487, 2s.

His Lordship moved approval of the following Special Grants, which were recommended by the Board of Directors:—

- (1) £100 to the Scottish Agricultural Organisation Society for the year 1941.
- (2) £10 to the Scottish Society for the Prevention of Cruelty to Animals.

Sir Joshua Ross-Taylor, Mungoswalls, Duns, seconded, and the Accounts and Special Grants were approved.

Argyll Naval Fund.

Mr J. W. Alexander, M.V.O., of Newton, Golfhill, Moffat, submitted the report on the Fund for the year ending 30th November 1940. The income for the year amounted to £314, 2s. 10d., while the expenditure comprised grants of £40 each to nine naval cadets, a total of £360. The balance of payments was made out of surplus income.

Scottish Red Cross Agriculture Fund.

Major R. F. Brebner, The Leuchold, Dalmony, Chairman of Directors, submitted the following report:—

"At the Half-Yearly General Meeting in June of last year it was reported that

a General Committee of the Scottish Red Cross Agriculture Fund had been formed, with an Executive Committee of twenty-five members, and that steps were being taken to establish local Committees throughout the different areas of Scotland. In the course of the summer such Committees were formed in connection with practically every Live Stock Market Centre in the country.

"The main object of these Committees was to arrange for Free Gift Sales of Live Stock, &c., as it was recognised that such sales were likely to prove most effective in raising money for the Fund. That this expectation was correct has been amply proved by the results. Over sixty Free Gift Sales have been held. The proceeds of forty-seven of these have been received up to this date, and these amount to a sum of practically £75,750. The proceeds of about thirteen sales have yet to be received. The total sum received by the Fund from all sources amounts, at this date, to £82,176, 12s. 6d.

"This remarkable result could not have been attained without the cordial co-operation of all the agricultural interests. Sincere thanks are due to the Directors of the Society and representatives of the National Farmers' Union and Chamber of Agriculture of Scotland, whose valuable help and co-operation made possible the formation of strong local Committees in the various areas. These local Committees included representatives of the many local Agricultural Societies throughout the country, and it is impossible to acknowledge adequately the tremendous amount of work done by these Committees in organising the numerous collections and Free Gift Sales. Cordial thanks are also due to the live stock auctioneers, without whose help the Free Gift Sales could not have been carried through. The auctioneers not only gave their services and the use of their marts free of charge, but in several cases also acted as Conveners or Secretaries of the local Committees."

The Earl of Home, as Chairman of the Scottish Red Cross Agriculture Fund Committee, said he was sure they were all agreed that this was a remarkably satisfactory result. He had received a most grateful letter from Lord Kinnaird, Chairman of the Scottish Branch, British Red Cross Society, saying how much he appreciated the great effort of the agricultural community.

Mr J. Milne Henderson, Edinburgh, Vice-Chairman of the Edinburgh Branch of the St Andrew's Ambulance Association, made an appeal for a grant from the Fund. He did not see why the whole of the money should be sent on to Glasgow. They had very much need of it in Edinburgh, and he was sorry that Sir John Fraser, their Chairman, was not able to be present to plead the cause. They had a considerable number of ambulances, but they required more. They covered a wide district around Edinburgh, including the Lothians and part of Fife. They would be very glad if the Society, before they parted with the money, gave them a grant of, say, £2000. He respectfully made that request to the Committee.

Colonel F. J. Carruthers of Dormont, Lockerbie, pointed out that this request was entirely out of order. The Fund was not the Highland and Agricultural Society's Fund—it was the Scottish Red Cross Agriculture Fund. The Highland and Agricultural Society had only inaugurated it. They had no power to allocate anything. It must be done by the Central Committee.

The Report was then approved.

Grants to Local Societies.

Mr James Paton, Kirkness, Glencraig, Vice-Convenor of the Shows Committee, intimated that the Directors had that day unanimously decided that all grants by the Society of money or medals in aid of local agricultural shows be suspended throughout the duration of the War.

In 1940 grants of money and medals were given to various local agricultural and other Societies throughout Scotland. The total expenditure under this head, including Long Service Awards and Medals for Ploughing and Hoeing Competitions, amounted to £392, 12s. 10d. Owing to the War, many local Shows were cancelled, and, accordingly, the expenditure was much less than that of former years.

For the year 1941 the Directors had authorised the following grants: twenty Horse Associations for grants of £15 each in respect of stallions engaged; £15 and fifteen Silver Medals to the Scottish National Union of Allotment Holders for Allotments; grants of £3 each to thirty-two Federations of Scottish Women's Rural Institutes as prize-money for 'Utility Gardens' Competitions; Long Service Awards and the usual Medals for Ploughing and Hoeing Competitions, estimated at £79, 12s. 6d.; and various smaller grants to Horticultural Societies, &c. The total estimated expenditure in 1941 under this head was £614, 18s. 9d.

Agricultural Education.

Colonel F. J. Carruthers of Dormont, Convener of the Education Committee, submitted the following Report on the Examinations held in 1940 :—

National Diploma in Agriculture.

As already intimated, the courses of study at several of the Agricultural Colleges in England during the Session 1939-40 were interrupted by reason of the War. Accordingly, the Examination Board decided to hold two Examinations in 1940, so that candidates might be given an opportunity to appear at either, as they found most suitable. The first Examination was held at Edinburgh, commencing on 3rd April. The results of that Examination had already been intimated.

The second Examination was held at the University of Leeds on 16th July and following days. At that Examination, as an effect of the War, only 70 candidates were present, principally from English centres. As a result of the Examinations 29 Diplomas were awarded.

Of the 70 candidates, 4 appeared for all subjects, but only 1 of those obtained the Diploma. 34 had passed certain subjects previously and were then completing the Examination, and of these, 28 succeeded in obtaining the Diploma. The remaining 32 presented themselves for first groups of three, four, or five subjects, and of these, 16 passed in the subjects for which they appeared, and were entitled to appear for the second group of subjects at a subsequent Examination.

National Diploma in Dairying.

The Forty-fifth Annual Examination for the National Diploma in Dairying took place during September 1940 at the Dairy School for Scotland, Auchincruive, Ayr, for Scottish students, and at the University and British Dairy Institute, Reading, for English and Welsh students.

At the Auchincruive centre, 41 candidates presented themselves—a number somewhat below the average of recent years. 35 candidates appeared for all subjects, and 6 for re-examination in certain subjects in which they had previously failed. 24 candidates obtained the Diploma—1 with Honours.

At the Reading centre, 77 candidates presented themselves—62 candidates for all subjects, 14 for re-examination in certain subjects, and 1 for Part II. of the Examination. 42 candidates obtained the Diploma—2 with Honours.

Of those candidates who failed, 7 at Auchincruive and 16 at Reading failed in not more than three subjects, and these will be permitted to reappear for the subjects in which they failed at a subsequent Examination.

Report by Chemist.

Dr J. F. Tocher, Consulting Chemist to the Society, submitted a Report on the work done in his department during the past half-year. The substance of the Report appears on pp. 127-133 of this volume.

Fertilisers.

Mr William Smith, B.Sc., Edinburgh, Secretary of the Scottish Fertilisers Distribution Committee, made a statement on the subject of fertilisers, and pointed out the position at the present time. He stressed the importance of getting out fertilisers to the farm immediately, because there was neither time, transport, nor labour to cope with the increased tonnage in the usual short six weeks unless supplies went out from then onwards.

Future of Agriculture.

Mr W. J. Campbell, Edinburgh, said there were two matters he wanted to bring before the Directors. One was that the Directors should consider the formation of a body to begin planning now a post-war agriculture after we had won the war. It would be a work of years, and the cosmopolitan membership of that Society eminently fitted it to take an active part with other agricultural bodies, farm workers, educationalists, manufacturers, craftsmen, and commercial

men of almost every line of life, for everybody should be interested in the oldest and greatest industry. That was the HIGHLAND and Agricultural Society, and as a striking example of past failure, his mind naturally turned to the depopulation of the Highlands, and the consequent loss of our first line of defence, largely owing to the neglect of a planned agriculture and of the fishing industry. The Government had now in some measure realised the seriousness of the situation, and he trusted that Major the Hon. Robert Bruce would see that the quickest, the most lasting, and most satisfactory way of amelioration was by way of agriculture. The question, however, was larger than the Highlands, larger than Scotland, larger than Britain, for they must think of their great and loyal Dominions, at present largely supplying them, and their gallant youth nobly fighting for them, as they saw at the week-end in the Australian great victory at Bardia. The immensity of the subject must be in the mind of everyone there, and they would like an assurance that the Society would grapple with the question.

The Chairman said the point Mr Campbell raised was fully discussed at a meeting of the Directors that day.

Major R. F. Brebner said that the matter referred to by Mr Campbell had been in his mind for some considerable time, and he brought it before the Directors informally that afternoon. It was now in the minds of the Directors, and he hoped that something would result from the very useful discussion that took place. He was not in a position to say more, but he thought if the suggestion did bear fruit, they would probably appoint a small Committee to consider how best they could set about tackling this enormous question. This Committee would probably be from inside and outside the Directorate; they must bring in the best brains in connection with agriculture in Scotland. As Mr Campbell said, it was a very big question, but it was now being seriously considered.

Mr Campbell said that was a most satisfactory statement. It ought to be known that the Directors were giving consideration to the matter.

Excess Profits Tax.

Mr Campbell said the other point he wished to bring forward was in regard to the 100 per cent Excess Profits Tax, which, he said, would prevent expansion, and consequently extra production. He suggested the formation of a Committee to consider the question of Agricultural Taxation, in order to advise those who were considering the matter in view of the coming Budget. He believed the Department of Agriculture was considering the subject in some of its aspects only, and no matter how well they might be advised, he thought there was still room for the driving force of informed agricultural opinion. With the exception of a lone voice here and there, there seemed to be general indifference—an indifference which, he ventured to say, might arise from ignorance. It was a mistake to entertain the hope that in estimating profits the present even level of valuation would be maintained, as the authorities could ask for a market valuation, and in farming that might lead to Income Tax and Excess Profits Tax having to be paid out of capital. In the course of time that would lead to the bankruptcy of the agriculturist, and his desire for the appointment of a Committee was to avoid that disaster. He said he need hardly add that nearly all the farmers affected were members of that Society.

The Secretary pointed out that this proposal could only go forward as a suggestion to the Board of Directors, and they would have to decide what was to be done with it.

The Chairman said the matter would be put before the Board at the next meeting.

Vote of Thanks.

On the motion of Mr George Grant of Glenfarclas, Blacksoat, a vote of thanks was accorded to the Earl of Home for presiding.

APPENDIX

PREMIUM BOOK

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

1941

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Address for communications:

JOHN STIRTON, Secretary,

The Highland and Agricultural Society of Scotland,
8 Eglinton Crescent,
Edinburgh 12.

GENERAL NOTICE.

THE HIGHLAND SOCIETY was instituted in the year 1784, and incorporated by Royal Charter in 1787. Its operation was at first limited to matters connected with the improvement of the Highlands of Scotland; but the supervision of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, several of the earlier objects contemplated by the Society were abandoned, while the progress of agriculture led to the adoption of others of a more general character. The exertions of the Society were thus early extended to the whole of Scotland, and have since been continuously directed to the promotion of the science and practice of agriculture in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter, in 1834, to THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

The Society avoids questions of political controversy, but in other public matters of practical concern to agriculture it seeks to guard and promote, by every means in its power, the welfare of all interested in the agriculture of Scotland.

Among the more important measures which have been effected by the Society are—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the principal towns of Scotland, at which exhibitors from all parts of Great Britain, Northern Ireland, and Eire (Irish Free State) are allowed to compete.
2. A system of District Shows instituted for the purpose of improving the breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Societies and Associations.
3. A scheme of Awards to Farm Workers for long and approved service in Scotland.
4. The encouragement of Agricultural Education, under powers conferred by a supplementary Royal Charter, granted in 1856, and authorising the Society to grant Diplomas to Students of Agriculture; and by giving grants in aid of education in Agriculture and allied sciences. In 1900 the Society discontinued its own Examination, and instituted jointly with the Royal Agricultural Society of England an Examination for a National Diploma in Agriculture.
5. The institution of an Examination for a National Diploma in Dairying, jointly with the Royal Agricultural Society of England and the British Dairy Farmers' Association.
6. The institution of an Examination in Forestry for First and Second Class Certificates. Terminated in 1935 in accordance with arrangements made with the Royal Scottish Forestry Society.
7. The advancement of the Veterinary Art, by conferring Certificates on Students who have passed through a prescribed curriculum, and who are found, by public examination, qualified to practise. Terminated in 1881 in accordance with arrangements made with the Royal College of Veterinary Surgeons.
8. The appointment of a Chemist for the purpose of promoting the application of science to agriculture.
9. The establishment of a Botanical Department.
10. The appointment of an Entomologist to advise members regarding insect pests, &c.
11. The annual publication of the 'Transactions,' comprehending papers by selected writers, Prize Reports, and reports of experiments, also an abstract of the business at Board and General Meetings, and other communications.
12. The management of a fund left by John, 5th Duke of Argyll (the original President of the Society), to assist young natives of the Highlands who enter His Majesty's Navy.

CONSTITUTION AND MANAGEMENT.

The general business of THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND is conducted under the sanction and control of the Royal Charters, referred to above, which authorise the enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Thirty-two Ordinary and Twenty Extraordinary Directors, a Treasurer, an Honorary and an Acting Secretary, an Auditor, and other Officers.

The Supplementary Charter of 1856 provides for the appointment of a Council on Education, consisting of Sixteen Members—Nine nominated by the Charter and Seven elected by the Society.

STATEMENT OF PRIVILEGES OF MEMBERS.

MEMBERS OF THE SOCIETY ARE ENTITLED—

1. *To receive a free copy of the 'Transactions' annually.*
2. *To apply for District Premiums that may be offered, and for Long Service Awards for Agricultural Employees.*
3. *To report Ploughing Matches for Medals that may be offered.*
4. *To Free Admission to the Shows of the Society.*
5. *To exhibit Live Stock and Implements at reduced rates.*

Firms are not admitted as Members; but if one partner of a firm becomes a Member the firm is allowed to exhibit at Members' rates.

6. *To have Fertilisers and Feeding-Stuffs, &c., analysed at reduced fees.*
7. *To obtain Reports on the Animal Enemies of Crop Plants and Live Stock (including Poultry).*
8. *To attend and vote at General Meetings of the Society.*
9. *To vote for the Election of Directors.*
&c., &c.

ANALYSES OF FERTILISERS AND FEEDING-STUFFS, &c.

The scale of Fees in respect of Analyses made by the Society's Chemist for Members of the Society will be found under "Chemical Department."

Valuations of manures, according to the Society's scale of units, will be supplied on application being made.

For further particulars, see under Chemical Department.

Chemist.—Mr J. F. TOCHER, D.Sc., LL.D., F.I.C., Crown Mansions, 41½ Union Street, Aberdeen.

REPORTS ON THE ANIMAL ENEMIES OF CROP PLANTS AND LIVE STOCK (INCLUDING POULTRY).

The Consulting Zoologist is prepared to send to any Member of the Society a Report on damage to, or diseases of, plants and animals due to animal agency (Insects, Mites, Worms, Snails, Slugs, Birds, and the Smaller Mammals).

For further particulars, see under Entomological Department.

Consulting Zoologist.—Mr A. E. CAMERON, M.A., D.Sc., Department of Agricultural and Forest Zoology, University of Edinburgh, 10 George Square, Edinburgh.

TERMS OF MEMBERSHIP, &c.

The influence and usefulness of the Society depend mainly upon its strength in membership. The Members, through the Directors whom they elect, have the practical control of the affairs of the Society. The stronger the body of Members, the greater will be the usefulness of the Society. It will therefore be to both their own and the public advantage if all who are interested in agriculture, and who are not already enrolled, should at once become Members of the Society.

ELECTION OF MEMBERS.

Candidates for admission to the Society must be proposed by a Member, and are elected at the half-yearly General Meetings in January and June. It is not necessary that the proposer should attend the Meeting.

RATES OF SUBSCRIPTION.

HIGHER SUBSCRIPTION.

The ordinary annual subscription is £1, 3s. 6d., and the ordinary subscription for life-membership is £12, 12s.; or after ten annual payments have been made, £7, 7s.

LOWER SUBSCRIPTION.

Proprietors farming the whole of their own lands, whose rental on the Valuation Roll does not exceed £500 per annum, and all Tenant-Farmers, Secretaries or Treasurers of Local Agricultural Associations, Factors resident on Estates, Land Stewards, Foresters, Agricultural Implement Makers, Grain, Seed and Manure Merchants, Agricultural Auctioneers, Cattle Dealers and Veterinary Surgeons, none of them being also owners of land to an extent exceeding £500 per annum, and such other persons as, in respect of their official or other connection with agriculture, the Board of Directors may consider eligible, are admitted on a subscription of 10s. annually, which may be redeemed by one payment of £7, 7s., and after eight annual payments of 10s. have been made, a Life Subscription may be purchased for £5, 5s., and after twelve such payments, for £3, 3s.

It must be stated, on behalf of Candidates claiming to be admitted at the Lower Rate of Subscription (10s.), under which of the above designations they are entitled: o be admitted at the Lower Rate.

Subscriptions are payable on election, and afterwards annually in January.

According to the Charter, a Member who shall not have objected to his election, on the same being intimated to him by the Secretary, cannot retire until he has paid, in annual subscriptions or otherwise, an amount equivalent to a life composition.

Members are requested to send to the Secretary the names and addresses of Candidates proposed for admission to the Society, at the same time stating whether the Candidates should be admitted at the £1, 3s. 6d. or 10s. rate.

Patron of the Society.—HIS MAJESTY THE KING.

OFFICERS AND DIRECTORS FOR 1940-1941.

President.

THE DUKE OF PORTLAND, K.G., P.C., G.C.V.O., Langwell,
Berriedale, Caithness.

Vice-Presidents.

THE DUKE OF SUTHERLAND, K.T., P.C., Dunrobin Castle, Golspie.
THE EARL OF LEVEN AND MELVILLE, Glenferness House, Nairn.
Sir DONALD W. CAMERON OF LOCHIEL, K.T., Achnacarry, Spean Bridge,
Inverness-shire.

Year of
Election.

Ordinary Directors.

- (R. WEMYSS HONEYMAN, Derculich, Strathtay, Perthshire.
A. W. MONTGOMERIE, Westburn Farm, Cambuslang, Lanarkshire.
ALEXANDER FORBES, Rettie, Banff.
- 1937 { Major Sir SAMUEL STRANG STEEL of Philiphaugh, Bt., Selkirk.
- PETER W. CRAWFORD, Dryfeholm, Lockerbie.
JOHN KERR, Yorkston, Gorebridge, Midlothian (*elected 3rd
January 1940*).
- (IAN M. CAMPBELL, Bal Blair, Invershin.
JAMES CLARK, Windlaw House, Carmunnock, Glasgow.
JAMES DURNO, Crichtie, Inverurie.
R. SCOTT AITON, M.C., Legerwood, Earlston.
- 1938 { T. G. WILSON, Carbeth Home Farm, Balfon Station.
J. W. ALEXANDER, M.V.O., of Newton, Golfhill, Moffat.
ROBERT PARK, Brunstane, Portobello, Midlothian.
FINLAY MACGILLIVRAY of Aldie, Tain.
DAVID BLAIR, Littleinch, Wormit, Fife.
GEORGE GRANT of Glenfarclas, Blacksboat.
The Hon. WALTER T. H. SCOTT, Master of Polwarth, Harden,
Hawick.
- 1939 { THOMAS M'LAY, Dunvegan, Causewayhead, Stirling.
PETER GORDON, Balcraig Moor, Port William.
JAMES HOPE, Eastbarns, Dunbar.
Captain IAN S. ROBERTSON, Linkwood, Elgin.
ALEXANDER CLARK, Strathore House, Thornton, Fife.
JAMES KILPATRICK, Craigie Mains, Kilmarnock.
THOMAS TEMPLETON, Sandyknowe, Kelso.
JAMES R. LUMSDEN of Arden, Dumbartonshire
J. FAED SPROAT, Boreland of Anwoth, Gatehouse, Castle
Douglas.
- 1940 { Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.
Major A. D. CAMPBELL, Stanstill, Wick.
JAMES PATON, Kirkness, Glencraig.
ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire
G. H. RUSSELL of The Burn, Glenesk, Brechin.

Year of
Election.

Extraordinary Directors.

- | | | |
|-------|---|--|
| 1939 | { | T. MERCER SHARP, Bardrill, Blackford. |
| | | Major R. W. SHARPE of The Park, Earlstoun. |
| | | JOHN P. SLEIGH of St John's Wells, Fyvie. |
| | | A. A. HAGART SPEIRS of Elderslie, Houston House, Renfrewshire. |
| | | JAMES WITHER, Awhirk, Stranraer. |
| | | |
| 1940 | { | WILLIAM I. ELLIOT, Middletoun, Stow, Midlothian. |
| | | J. E. KERR of Harviestoun, Dollar. |
| | | WILLIAM MONTGOMERY, North Milton, Kirkcudbright. |
| | | Sir JOSHUA ROSS-TAYLOR, Mungoswalls, Duns. |

Shew Division Directors.

- | | | |
|------|---|---|
| 1939 | { | JAMES H. FRASER, Easter Lovat, Beauly. |
| | | Lieut.-Colonel M. J. GRANT-PETERKIN of Grange, Grange Hall, Forres. |
| | | JAMES MACKESSACK LEITCH, Carden, Alves, Forres. |
| | | KENNETH P. MACGILLIVRAY, Kirkton, Bunchrew, Inverness. |
| | | Provost HUGH MACKENZIE, Inverness. |
| | | |
| | | RALPH S. MACWILLIAM, Garguston, Muir of Ord. |
| | | Major GIDEON C. RUTHERFORD, Proncy, Dornoch. |
| | | Major JOHN STIRLING of Fairburn, Muir of Ord. |
| | | FRANCIS W. WALKER of Leys, Leys Castle, Inverness. |

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 A. E. CAMERON, M.A., D.Sc., University of Edinburgh, 10 George Square, Edinburgh, *Consulting Zoologist*.
 The Very Rev. CHARLES L. WARR, D.D., 63 Northumberland Street, Edinburgh, *Chaplain*.
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 HAMILTON & INCHES, Princes Street, Edinburgh, *Silversmiths*.
 ALEXANDER KIRKWOOD & SON, 9 St James' Square, Edinburgh, *Medallists*.
 JOHN MENZIES & Co. LTD., 6 Castle Street, Edinburgh, *Advertising Agents*.
 FRANK REID, 55 Blenheim Place, Aberdeen, *Showyard Erector*.
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Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.

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1. *Argyll Naval Fund* MACLACHLAN OF MACLACHLAN, Castle Lachlan, Strathlachlan.
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3. *Publications* Colonel F. J. CARRUTHERS of Dormont, Lockerbie.
4. *Shows* IAN M. CAMPBELL, Bal Blair, Invershin.
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9. *Office-Bearers* Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.

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 JAMES PATON, Kirkness, Glencraig.
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 T. G. WILSON, Carbeth Home Farm, Balfron Station.
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GEORGE GRANT of Glenfarclas, Blacksboat.

J. E. KERR of Harviestoun, Dollar.

JAMES R. LUMSDEN of Arden, Dumbartonshire.

WILLIAM MONTGOMERY, North Milton, Kirkcudbright.

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JAMES PATON, Kirkness, Glencairn.

Captain IAN S. ROBERTSON, Linkwood, Elgin.

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4. SHOWS.

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JAMES CLARK, Windlaw House, Carmunnock, Glasgow.

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WILLIAM I. ELLIOT, Middleton, Stow, Midlothian.

ALEXANDER FORBES, Rettie, Banff.

JAMES H. FRASER, Easter Lovat, Beaulieu.

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GEORGE GRANT of Glenfarclas, Blacksboat.

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JAMES HOPE, Eastbarns, Dunbar.

J. E. KERR of Harviestoun, Dollar.

JOHN KERR, Yorkston, Gorebridge, Midlothian.

JAMES KILPATRICK, Craigie Mains, Kilmarnock.

JAMES MACKESSACK LEITCH, Carden, Alves, Forres.

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Provost HUGH MACKENZIE, Inverness.

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 JAMES WITHER, Awhirk, Stranraer.
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ex officio.

5. IMPLEMENTS AND MACHINERY.

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 PETER GORDON, Balcraig Moor, Port William.
 JAMES HOPE, Eastbarns, Dunbar.
 J. E. KERR of Harviestoun, Dollar.
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 Chairman of Board of Directors, *ex officio*.
 The EARL OF HOME, K.T., The Hirsell, Coldstream, Treasurer, *ex officio*.
 Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary,
ex officio.

6. SCIENCE.

Major ROBERT W. SHARPE of The Park, Earlstoun, *Convener*.
 T. G. WILSON, Carbeth Home Farm, Balfron Station, *Vice-Convener*.
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 DAVID BLAIR, Littleinch, Wormit, Fife.
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 JAMES R. LUMSDEN of Arden, Dumbartonshire.
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 ROBERT PARK, Brunstane, Portobello, Midlothian.
 JAMES PATON, Kirkness, Glencaig.
 Sir JOSHUA ROSS-TAYLOR, Mungoswalls, Duns.
 The Hon. WALTER T. H. SCOTT, Master of Polwarth, Harden, Hawick.
 T. MERCER SHARP, Bardrill, Blackford.
 A. A. HAGART SPEIRS of Elderslie, Houston House, Renfrewshire.
 Major Sir SAMUEL STRANG STEEL of Philiphaugh, Bt., Selkirk.
 THOMAS TEMPLETON, Sandyknowe, Kelso.
 FRANCIS W. WALKER of Leys, Leys Castle, Inverness.
 JAMES WITHER, Awhirk, Stranraer.
 The EARL OF HOME, K.T., The Hirsell, Coldstream, Treasurer, *ex officio*.
 Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary,
ex officio.
 J. F. TOCHER, D.Sc., LL.D., F.I.C., 41½ Union Street, Aberdeen, Chemist,
ex officio.
 A. E. CAMERON, M.A., D.Sc., University of Edinburgh, 10 George Square,
 Edinburgh, Consulting Zoologist, *ex officio*.

7. GENERAL PURPOSES.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh,
 Chairman of Board of Directors, *Convener*.
 R. SCOTT AITON, M.C., Legerwood, Earlston.
 DAVID BLAIR, Littleinch, Wormit, Fife.
 ALEXANDER CLARK, Strathore House, Thornton, Fife.
 JAMES CLARK, Windlaw House, Carmunnock, Glasgow.
 JAMES DURNO, Crichtie, Inverurie.
 WILLIAM I. ELLIOT, Middletoun, Stow, Midlothian.
 JAMES HOPE, Eastbarns, Dunbar.
 J. E. KERR of Harviestoun, Dollar.
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 ROBERT PARK, Brunstane, Portobello, Midlothian.
 JAMES PATON, Kirkness, Glencaig.
 Sir JOSHUA ROSS-TAYLOR, Mungoswalls, Duns.
 The Hon. WALTER T. H. SCOTT, Master of Polwarth, Harden, Hawick.
 Major ROBERT W. SHARPE of The Park, Earlston.
 THOMAS TEMPLETON, Sandyknowe, Kelso.
 The EARL OF HOME, K.T., The Hirsell, Coldstream, Treasurer, *ex officio*.
 Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary,
ex officio.

8. EDUCATION.

Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary,
Convener.
 Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh,
 Chairman of Board of Directors.
 ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire.
 Sir JOSHUA ROSS-TAYLOR, Mungoswalls, Duns.
 T. G. WILSON, Carbeth Home Farm, Balfon Station.
 JOHN STIRTON, 8 Eglinton Crescent, Edinburgh, Secretary.

9. OFFICE-BEARERS.

Constitution : (1) The four Ordinary Directors for the Division in which the Show for the year is to be held (with the exception of one retiring next year) ; (2) one Ordinary Director from each of the other Show Divisions ; and (3) the Chairman of the Board, Treasurer, and Hon. Secretary, *ex officio*.

<i>Perth</i>	{	DAVID BLAIR, Littleinch, Wormit, Fife.
		ALEXANDER CLARK, Strathore House, Thornton, Fife.
<i>Glasgow</i>	{	JAMES PATON, Kirkness, Glencraig.
		ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire.
<i>Aberdeen</i>	.	JAMES Durno, Crichton, Inverurie.
<i>Borders</i>	.	The Hon. WALTER T. H. SCOTT, Master of Polwarth, Harden, Hawick.
<i>Stirling</i>	.	T. G. WILSON, Carbeth Home Farm, Balfon Station.
<i>Dumfries</i>	.	J. W. ALEXANDER, M.V.O., of Newton, Golfhill, Moffat.
<i>Edinburgh</i>	.	ROBERT PARK, Brunstane, Portobello, Midlothian.
<i>Inverness</i>	.	FINLAY MACGILLIVRAY of Aldie, Tain.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, Chairman of Board of Directors, *ex officio*.
 The EARL OF HOME, K.T., The Hirsell, Coldstream, Treasurer, *ex officio*.
 Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary, *ex officio*.

REPRESENTATIVES ON OTHER BODIES.

National Agricultural Examination Board and National Dairy Examination Board.

Colonel F. J. CARRUTHERS of Dormont, Lockerbie.
 Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.
 ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire.
 Sir JOSHUA ROSS-TAYLOR, Mungoswalls, Duns.
 T. G. WILSON, Carbeth Home Farm, Balfon Station.
 JOHN STIRTON, 8 Eglinton Crescent, Edinburgh.

Edinburgh and East of Scotland College of Agriculture.

JOHN STIRTON, *Secretary*, Highland and Agricultural Society of Scotland,
8 Eglinton Crescent, Edinburgh.

West of Scotland Agricultural College.

JAMES R. LUMSDEN of Arden, Dumbartonshire.

Aberdeen and North of Scotland College of Agriculture.

J. F. TOCHER, D.Sc., LL.D., F.I.C., 41½ Union Street, Aberdeen.

Royal (Dick) Veterinary College.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.

Glasgow Veterinary College.

ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire.

Scottish Milk Records Association.

JAMES KILPATRICK, Craigie Mains, Kilmarnock.

WILLIAM MONTGOMERY, North Milton, Kirkcudbright.

JAMES WITHER, Awhirk, Stranraer.

National Trust for Scotland.

The Hon. WALTER T. H. SCOTT, Master of Polwarth, Harden, Hawick.

Royal Scottish Agricultural Benevolent Institution.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.

Association for the Preservation of Rural Scotland.

The Hon. WALTER T. H. SCOTT, Master of Polwarth, Harden, Hawick.

Scottish Country Industries Development Trust.

The Hon. WALTER T. H. SCOTT, Master of Polwarth, Harden, Hawick.

LAURENCE R. YOUNGER, Dabton, Thornhill, Dumfriesshire.

Scottish National Association of Young Farmers' Clubs.

JAMES PATON, Kirkness, Glencraig.

SCOTTISH PLANT REGISTRATION STATION.**Standing Committee of Management.**

Major R. F. BREBNER, The Leuchold, Dalmeny
House, Edinburgh.

JAMES HOPE, Eastbarns, Dunbar.

JAMES WITHER, Awhirk, Stranraer.

*Appointed for
5 years from 1st
January 1941.*

MEETINGS.

General Meetings.—By the Charter the Society must hold two General Meetings each year, and, under ordinary circumstances, they are held in the months of January and June, for the election of Members and other business. Twenty a quorum.

By a resolution of the General Meeting held on 15th January 1879, a General Meeting of Members is held in the Showyard on the occasion of the Annual Show.

With reference to motions at General Meetings, Bye-Law No. 19 provides that—"At General Meetings of the Society no motion or proposal (except of mere form or courtesy) shall be submitted or entertained for immediate decision unless notice thereof has been given two weeks previously to the Board of Directors, without prejudice, however, to the competency of a motion or proposal, of which due notice has not been given, being remitted to the Directors for consideration, and thereafter being disposed of at a future General Meeting."

Directors' Meetings.—The Board of Directors meet (except when otherwise arranged) on the first Wednesday of each month from November to June, inclusive, at 1.30 p.m., and occasionally as business may require, on a requisition by three Directors to the Secretary, or on intimation by him. Seven a quorum.

Committee Meetings.—Meetings of the various Committees are held as required.

Nomination of Directors.—Meetings of Members, for the purpose of nominating Directors to represent the Show Divisions on the Board for the year 1942-1943, will be held at the places and on the days after-mentioned :—

DIVISION.		
1. <i>Edinburgh.</i>	Market Buildings, Gorgie, Edinburgh	Wed., 28th Jan. 1942, at 1.
2. <i>Glasgow.</i>	Central Station Hotel, Glasgow	Wed., 11th Feb. 1942, at 1.
3. <i>Stirling.</i>	Golden Lion Hotel, Stirling	Thur., 12th Feb. 1942, at 1.30.
4. <i>Perth.</i>	County Buildings, Cupar	Tues., 17th Feb. 1942, at 2.30.
(The Meeting will be held in 1943 at Cupar; in 1944 and 1945 at Perth.)		
5. <i>Borders</i>	....., St Boswells	Thur., 19th Feb. 1942, at 3.
6. <i>Inverness.</i>	Station Hotel, Inverness	Tues., 24th Feb. 1942, at 2.
7. <i>Aberdeen.</i>	Imperial Hotel, Aberdeen	Fri., 27th Feb. 1942, at 2.30.
8. <i>Dumfries.</i>	King's Arms Hotel, Dumfries	Wed., 11th March 1942, at 2.

The nomination of a Proprietor or other Member paying the higher subscription must be made in the 3rd, 6th, 7th and 8th Divisions; and the nomination of a Tenant-Farmer or other Member paying the lower subscription in the 1st, 2nd, 4th and 5th Divisions.

A Member who has served as an Ordinary Director for a term of four years is not eligible to be nominated again till after the lapse of at least one year. An Extraordinary Director may, however, be nominated as an Ordinary Director.

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GENERAL SHOW.

Owing to the outbreak of War, the Board of Directors decided to cancel all Shows for the duration of the War.

EXAMINATIONS.

Agriculture.—The Examination in 1941 for the National Diploma in Agriculture will be held at the University of Leeds on Tuesday, 1st April, and following days. Applications close on Thursday, 20th February.

Dairying.—The Examination in 1941 (Scottish Centre) for the National Diploma in Dairying will be held at the Dairy School for Scotland, Auchincruive, Ayr: *Written*—On Wednesday, Thursday, and Friday, 3rd, 4th, and 5th September. *Oral and Practical*—On Monday, 15th September, and following days. Applications close on Thursday, 31st July.

Forestry.—The Final Examination for the Society's First and Second-Class Certificates in Forestry was held in 1935.

In view of the institution of Examinations for Certificates and Diplomas in Forestry by the Royal Scottish Forestry Society, and by arrangement with that Society, the Board of Directors of the Highland and Agricultural Society of Scotland resolved in 1935 to cease holding further Examinations for the First and Second-Class Certificates, and that, in future, the granting of Certificates and Diplomas be left in the hands of the Royal Scottish Forestry Society.

All communications in connection with Examinations in Forestry should now be addressed to the Secretary, Royal Scottish Forestry Society, 8 Rutland Square, Edinburgh 1.

NATIONAL DIPLOMA IN AGRICULTURE

By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to grant Diplomas.

From 1858 to 1899 the Society held an annual Examination for Certificate and Diploma in Agriculture. In 1873 the Free Life Membership of the Society was granted to winners of the Diploma. In 1882 permission was given to holders of the Diploma to append the letters F.H.A.S. to their names. These arrangements terminated in 1899.

In 1898 it was resolved by the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland to discontinue the independent Examinations in Agriculture held by the two Societies, and to institute in their stead a Joint-Examination for a NATIONAL DIPLOMA IN AGRICULTURE (N.D.A.). This Examination is now conducted under the management of "The National Agricultural Examination Board" appointed by the two Societies. The first Joint Examination was held in 1900.

REGULATIONS FOR EXAMINATION IN THE SCIENCE AND PRACTICE OF AGRICULTURE

EXAMINATION IN 1941.

1. The Societies may hold conjointly, under the management of the National Agricultural Examination Board appointed by them, an Annual Examination in the Science and Practice of Agriculture, at a convenient centre.

2. Candidates who pass the Examination will receive the National Diploma in Agriculture—the Diploma to be distinguished shortly by the letters "N.D.A."

3. The Examination will be conducted by means of written papers and oral examinations.

4. In order to be eligible to sit for the Board's Examination in Agriculture, a candidate must—

(a) Present a certificate from a recognised Agricultural College that his attainments in the subjects of *General Botany, Geology, General Chemistry, Physics, and Mechanics*, as attested by class and other examinations, are, in the opinion of the authorities of the College, such as to justify his admission to the Board's Examination; *or*

(b) Produce evidence that he has passed the 1st B.Sc. or the Intermediate Examination in Science of a British University; *or*

(c) Present a School Certificate awarded by a British University Examination Board, and produce evidence that he has continued his study of science for at least a year and has obtained a certificate in Physics, Chemistry and Botany at the Higher Certificate Examination of a British University Examination Board; *or*

(d) Present a Leaving Certificate in Science (including Chemistry and Botany) of the Scottish Education Department.

5. In the case of students who satisfy the Board that they have not had the facilities for obtaining the foregoing certificates, the Board will be prepared to consider evidence of equivalent attainment. [Applications under this rule must be lodged *three months* before the date of the annual examination.]

6. *Before sitting for the PRACTICAL AGRICULTURE and FARM MACHINERY AND IMPLEMENTS papers, all candidates must produce evidence of possessing a practical knowledge of Agriculture obtained by residence on a farm in the British Isles for a period or periods (not more than two) covering a complete year of farming operations.*

7. Candidates will have the option of taking the whole of the following nine papers at one time, or of sitting for a group of *any three, four, or five* in the first year and the remaining subjects (at one examination) within the next two years:—

SUBJECT.	Maximum Marks.	Pass Marks.
1. Practical Agriculture (First Paper)	400	240
2. Practical Agriculture (Second Paper)	400	240
3. Farm Machinery and Implements	300	150
4. Land Surveying and Farm Buildings	100	50
5. Agricultural Chemistry . . .	200	100
6. Agricultural Botany . . .	200	100
7. Agricultural Book-keeping . . .	200	100
8. Agricultural Zoology . . .	100	50
9. Veterinary Science and Hygiene .	200	100
	<hr/> 2100	<hr/> 1130

NOTE.—Candidates taking the Examination in two groups of subjects are recommended to take Agricultural Chemistry and Agricultural Botany in the first group.

8. A candidate who obtains not less than three-fourths (1575) of the aggregate maximum marks (2100) in the entire Examination will receive the Diploma with Honours, provided that he obtains not less than three-fourths (600) of the maximum marks (800) in the two Practical Agriculture papers.

9. Candidates electing to take the entire Examination at one time and failing in not more than three subjects may appear for these subjects in the following year. Failure in more than three subjects will be regarded as failure in the whole Examination.

10. In the case of candidates electing to take the Examination in two groups—

(a) A candidate appearing for a group of *three* subjects and failing in a single subject may, *in the case of a first group*, appear for that subject along with the second group, or, *in the case of a second group*, in the following year. Failure in more than one subject will be regarded as failure in the group.

(b) A candidate appearing for a group of *four* or more subjects and failing in not more than two subjects may, *in the case of a first group*, appear for these subjects along with the second group, or, *in the case of a second group*, in the following year. Failure in more than two subjects will be regarded as failure in the group.

11. Non-returnable fees must be paid by candidates as follows :—

Entire Examination	Six guineas.
Group of subjects	Three guineas.
Reappearance for any subjects	10/6 per subject.

12. The Board reserve the right to postpone, abandon, or in any way, or at any time, modify an Examination, and also to decline at any stage to admit any particular candidate to the Examination.

The Examination will take place at LEEDS UNIVERSITY on TUESDAY, 1st APRIL 1941, and following days.

Forms of Application for permission to sit at the Examination may be obtained from "The Secretary, Royal Agricultural Society of England, 16 Bedford Square, London, W.C.1." or from "The Secretary, Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh 12," and must be returned duly filled up not later than THURSDAY, 20TH FEBRUARY 1941.

SYLLABUS OF SUBJECTS OF EXAMINATION.

PRACTICAL AGRICULTURE.

1.—FIRST PAPER.

1. *British Farming*.—Arable, stock-raising, dairying—Approximate areas covered by the different systems—Typical examples of each—Area in Great Britain under chief crops—Numbers of live stock—The recent history of agriculture—Short summary of agricultural returns.

2. *Climate*.—The effect of climate on farming practice—Rainfall—Temperature—Prevailing winds—Weather forecasts.

3. *Soils*.—The influence of geological formations on the systems of farming—Classification of soils—Character and composition—Suitability for cultivation. Reclamation—Drainage—Irrigation—Warping—Application of lime and marl—Bare fallows—Tillage—Subsoiling—Deep and thorough cultivation.

4. *Manures*.—The manures of the farm—The treatment of farm-yard manure—The disposal of liquid manure and sewage—General manures—Special manures—Field trials of manures—The application of manures—Period of application and amounts used per acre—Unexhausted value of manures and feeding-stuffs.

5. *Crops*.—Wheat, barley, oats, rye, beans, peas, potatoes, turnips, swedes, mangolds, sugar beet, forage plants, hops, and other crops—Their adaptation to different soils and climates—Varieties—Selection of seed—Judging seeds—Cultivation, weeds and parasitic plants, best methods of prevention and eradication—Harvesting—Storing—Cost of production—Improvement of crops by selection and hybridising—Field trials—Methods which the farmer may adopt—Selection to resist disease—The principles of rotations—Rotations suitable for different soils and climates—Rotations and the maintenance of fertility—Green manuring—Leguminous crops in rotation—Catch crops—The advantages and disadvantages of rotations—Specialised farming—Management of Orchards.

2.—SECOND PAPER.

6. *Live Stock*.—The different breeds of British live stock—Their origin, characteristics, and comparative merits—Suitability for different districts—Breeding—General principles—Selection—Mating—Crossing—Rearing and general management—Breeding and rearing of horses, cattle, sheep, pigs, and poultry. Rearing colts and raising store stock—The foods of the farm—Their composition and suitability for different classes of stock—Purchased foods—Composition and special value—Rations for different kinds and ages of stock—Cost of producing beef, mutton, pork, and milk—Cost of feeding farm horses.

7. *The disposal of Crops, Produce, and Stock*.—Marketing grain and other crops—Sale of stock—Live weight—Dead weight.

8. *Milk*.—The production and treatment of milk—The manufacture of cheese, butter, &c.—The utilisation of by-products.

9. *Farming Capital*.—Calculations of the stocking and working of arable, stock, and dairy farms—Farm valuations—Rent and taxes.

10. *Labour*.—Organisation of labour—piece-work, time-work—labour costings.

11. *Renting a Farm*.—Indications of condition, productive power, and stock-carrying capacity—Leases—Conditions of occupancy.

N.B.—*It is essential that a candidate know his subject practically, and that he satisfy the Examiner of his familiarity with farm work and management.*

3.—FARM MACHINERY AND IMPLEMENTS.

1. *Power*.—The principle of action, construction, method of working, also care and management of steam engines and boilers, gas, oil and petrol engines and agricultural tractors. Cost and working expenses in connection with the above. Estimation of the brake horse-power of engines. Power derived from water. Measurement of the quantity of water flowing in a stream. General arrangement of water-power plants. Water-wheels. Turbines. Pumps—principle of action and construction. Flow of water through pipes. Hydraulic ram. Windmills.

2. *Agricultural Implements and Machinery*.—The mode of action and the general principles involved in the construction and working of farm implements and machinery. Arrangements of machinery with respect to the power plant. Pulleys and belting. Shafting and bearings. Lubrication. Lifting appliances. Strength and care of chains. Concrete and its use in the construction of simple foundations for engines and machines.

3. *Implements of Cultivation*.—Ploughs—Cultivators—Grubbers—Harrows—Drills. Manure Distributors. Seeding and planting implements.

4. *Implements of Harvesting*.—Mowing and Reaping machines—Rakes—Teddies—Elevators—Potato raisers.

5. *Implements of Transit*.—Carts, waggons, rick lifters, tractors.

6. *Threshing and Food-preparing Machinery.*—Threshing machines, stationary and portable—Screen Winnowers—Hummelers, Chaff cutters—Pulpers—Cake breakers.

7. *Dairy Appliances.*—Milking machines—Cream separators—Churns and other butter-working appliances—Milk delivery cans—Cheese-making utensils—Vats and presses.

N.B.—*Candidates are expected to have had some experience with agricultural machinery and implements under actual working conditions, and to be capable of illustrating their answers, when necessary, by intelligible sketches or diagrams.*

4.—LAND SURVEYING AND FARM BUILDINGS.

1. The use and adjustment of instruments employed in Surveying and Levelling other than the Theodolite.

2. Land surveying by chain, Plotting from field book, and determination of areas surveyed. The simpler "field problems."

3. Levelling and plotting from field book.

4. A knowledge of the various classes of maps published by the Ordnance Survey Department and their Scales.

5. *Roads and Fences.*—The construction and maintenance of farm roads, fences, and ditches.

6. *Land Drainage.*—Methods of draining; mole and pipe drains; cost of construction and maintenance.

7. *Buildings.*—Buildings required on different classes of farms—Economical arrangement of farm buildings—Materials—Construction—Ventilation—Drainage—Water supply—Dimensions of dairy, stables, cowsheds, yard, courts, and piggeries—Accommodation for power—Implement, machinery, and cart sheds—Hay and grain sheds—Shelter sheds—Storage of manure.

N.B.—*Each candidate should have with him at the Examination a pair of compasses, scales of equal parts, including scales of one chain to the inch, 4 feet to the inch, 8 feet to the inch, and the scale fitting the Ordnance Map, $\frac{1}{2500}$ or 25·344 inches to the mile, a small protractor, a set-square, and a straight-edge about 18 inches in length.*

5.—AGRICULTURAL CHEMISTRY.

1. *The Atmosphere.*—Its composition and relations to plant and animal life.

2. *Water.*—Rain water—Soil water and drainage—Drinking water—Sewage and irrigation.

3. *The Soil.*—Origin, formation, and classification of soils—Sampling—Analysis—Composition of soils—The chemical and physical properties of soils—The water and air of the soil—Biological changes in the soil—The soil in relation to plant growth—Fertility—Causes of infertility—Improvement of soils.

4. *Manures.*—Theories of manuring—Classification of manures—Origin, nature, and characteristics of manures—Manufacture of

manures—Composition, analysis, adulteration, and valuation of manures—Farmyard manure and other natural manures—Green-manuring—Liming, marling, claying—Artificial manures, their origin and manufacture—Fertilisers and Feeding Stuffs Act—Sampling of manures.

5. *Poisons, Antiseptics, and Preservatives.*—General chemical composition and character of insecticides, fungicides, antiseptics, and preservatives used on the farm.

6. *Plants and Crops.*—Constituents of plants—Assimilation and nutrition of plants—Sources of the nitrogen and other constituents of plants—Germination—Action of enzymes—Composition and manurial requirements of farm crops—Food products derived from crops—Manuring experiments.

7. *Animals.*—Composition of animal body—Animal nutrition—Digestion—Assimilation, metabolism, respiration, and excretion.

8. *Foods and Feeding.*—Constituents of foods—Origin, nature, and composition of chief feeding stuffs—Sampling, analysis, and adulteration of foods—Nutritive value and digestibility of food—Functions of chief food constituents—Energy values—Vitamins—Relation of foods to the production of work, meat, milk, and manure—Manurial residues of foods.

9. *Dairy Chemistry.*—The composition of milk, cream, butter, cheese, &c.—Conditions which influence the composition of milk and milk products—Action of ferments and enzymes on milk and milk products—Milk-testing—Analysis and adulteration of dairy products.

N.B.—*Candidates who are in possession of Laboratory Notes are required to bring them to the Oral Examination in this subject.*

6.—AGRICULTURAL BOTANY.

In addition to a *general knowledge* of the morphology, histology, and physiology of plants, candidates will be expected to possess a *detailed knowledge* of the following subjects:—

The classification of plants of importance in agriculture as shown by a detailed study of the genera, species, and botanical varieties of the British Crop Plants and Weeds included in the following families:—

Ranunculaceæ.	Umbelliferae.	Chenopodiaceæ.
Cruciferae.	Compositæ.	Polygonaceæ.
Caryophyllaceæ.	Solanaceæ.	Liliaceæ.
Leguminosæ.	Scrophulariaceæ.	Gramineæ.
Rosaceæ.	Labiatae.	

British grasses of agricultural importance: recognition of, at any stage of growth. Habitats of important species. Constitution of the grass flora of good meadows and pastures. Composition of seed mixtures for temporary and permanent leys on various soils. The effects of artificial manures on the flora of grass land.

The weeds of arable and grass land. Poisonous and parasitic weeds. Methods of distribution by seed and vegetatively: of eradication. Weeds as soil indicators. Recognition of the seeds of the common weeds, particularly those characteristically found in clover, grass, &c., seed.

The chief varieties of wheat, barley, oats, clovers, roots, and other farm crops; their suitability for various climatic and soil conditions. The identification of the more important types of cereals by means

of their grain characters. Characteristics of good and bad samples of cereals.

Identification of materials used in feeding cakes and meals.

Plant-breeding. Principles of heredity in plants. Pure lines. Fluctuating variability. Selection.

Disease in plants. Diseases due to the effects of parasitic fungi. Resistance to disease: conditions affecting. Fungoid diseases scheduled from time to time by the Ministry of Agriculture and Fisheries.

Yeasts and fermentation.

The general outlines of bacteriology: nitrogen fixation, nitrification, and denitrification. Putrefaction and the bacteriology of milk, butter, and cheese.

N.B.—Candidates who are in possession of Laboratory Notes are required to bring them to the Oral Examination in this subject.

7.—AGRICULTURAL BOOK-KEEPING.

1. Advantages of book-keeping to the farmer. Difficulties and how they can be overcome. Objects of book-keeping.

2. General principles of book-keeping. Double-entry system. Description and use of various books. Ledger, journal, cash-book, petty cash-book, day-books, &c. Entering transactions; posting; trial balance; closing the accounts. Single-entry system.

3. Special ledger accounts: Interest depreciation, rent and rates, improvements, private and household expenses, profit and loss and capital; partnership accounts.

4. Bank business. Opening a bank account. Use of cheques. Deposits and overdrafts.

5. General office work; correspondence, order notes, invoices, rendering accounts, receipts, &c. Filing systems.

6. Farm valuations for book-keeping purposes. Dates for stock-taking and principles of valuation. The farm balance-sheet.

7. Systems of farm book-keeping. Conditions that determine the most suitable system. Advantages and drawbacks of each system.

8. Accounts for the owner-occupier. Treatment of rent. Incidence of rates and tithe in England and Scotland, and their treatment as between farm and estate accounts. Improvements and upkeep and the general principles relating to maintenance claims.

9. Cost accounting. General principles and methods. Advantages, objects, difficulties.

10. Interpretation of results from ordinary and from cost accounts. Precautions necessary. Use of accounts as a guide to efficient management.

11. Income Tax. How the farmer is assessed. Preparation of Income Tax return. Treatment of Income Tax in accounts.

8.—AGRICULTURAL ZOOLOGY.

The Examination is designed to test practical knowledge, and therefore Candidates will be expected to recognise the animals of agricultural importance referred to in the Syllabus.

GENERAL.

A general knowledge of the characteristics of living animals and how they differ from plants.

One-celled animals, *e.g.*, Amœba, and many-celled animals.

General outline of the classification of animals and the characters on which it is based.

Organic Evolution. Theories of Heredity.

SPECIAL.

I. *Invertebrates*.—A. The Worm Parasites of Stock. Flat and Round Worms. Structure and Life History, for example, of Liver-fluke, Tapeworm, Ascaris. The mode of life and life history of the chief worm enemies of the domesticated animals. Preventive and remedial measures.

B. The Arachnid enemies of Stock : Mange or Scab Mites, Demodex Mites, Ticks. External structure and life history. Control measures.

C. The Insect enemies of Stock : (a) External parasites, *e.g.*, gadflies, warble flies, blue-bottles, green-bottles, stable fly, ked, lice ; (b) Internal parasites, *e.g.*, bot and warble flies.

D. Insects injurious to Crops : Structure and classification of insects. Mode of life and life history of the chief insect pests of agricultural crops.* Control, preventive and remedial measures—natural control ; artificial control (Insecticides).

* *The chief pests are detailed in Pamphlets issued by the Ministry of Agriculture and Fisheries.*

E. Other invertebrates of agricultural importance, *e.g.*, earth-worms, eelworms, slugs and snails, centipedes and millepedes, gall mites.

II. *Vertebrates*.—Birds : the commoner birds of farm importance, their recognition and an estimate of their work.

Mammals : Outstanding characters for recognition, and the economic importance of :—

1. Ungulata or Hoofed Mammals, *e.g.*, horse, pig, cattle, sheep, deer.
2. Rodentia or Gnawing Mammals, *e.g.*, hares, rabbits, rats, mice, voles, squirrels.
3. Insectivora, *e.g.*, mole, hedgehog, shrew.
4. Carnivora, *e.g.*, dog, fox, polecat, stoat, weasel, badger.

N.B.—*Candidates who are in possession of Laboratory Notes are required to bring them to the Oral Examination in this subject.*

9.—VETERINARY SCIENCE AND HYGIENE.

1. Elementary anatomy and physiology of the horse, ox, sheep, and pig, and their relation to unsoundness and disease.

2. The general principles of breeding—including the physiology of reproduction, the laws of heredity, the periods of gestation, and the signs of pregnancy in the mare, cow, ewe, and sow.

3. Dentition as a means of determining the age of horses, cattle, sheep, and swine.

4. The management of farm stock in health and disease.

N.B.—*Candidates who are in possession of Laboratory Notes are required to bring them to the Oral Examination in this subject.*

WINNERS OF DIPLOMA IN 1940.**EXAMINATION AT EDINBURGH IN APRIL.***Diploma.*

- ARTHUR ADAM, West of Scotland Agricultural College, Glasgow.
ROLAND ADAMS, University of Leeds.
HUGH REGINALD BIRKS, University of Leeds.
GEORGE THOMSON CHALMERS, Claremont Villa, Ladybank, Fife.
JAMES CRAIG, West of Scotland Agricultural College, Glasgow.
DUNCAN WILLIAM CUNNINGHAM, West of Scotland Agricultural College, Glasgow.
DOUGLAS GEORGE DEMPSTER, University of Aberdeen and North of Scotland College of Agriculture.
JAMES ROBERTSON DEVINE, University of Glasgow and West of Scotland Agricultural College.
MAURICE WILLIAM GEE, Midland Agricultural College, Sutton Bonington, Loughborough.
ALBERT TERMONDE HAESLER, Seale Hayne Agricultural College, Newton Abbot, Devon.
ROBERT LOUIS HAGGART, University of Glasgow and West of Scotland Agricultural College.
FRANK MICHAEL LAVERACK, University of Leeds.
IAN ALLISON MACFARLANE, West of Scotland Agricultural College, Glasgow.
DONALD JOHN MACLEAN, West of Scotland Agricultural College, Glasgow.
FRANK LAWSON MATTHEWS, South-Eastern Agricultural College, Wye, Kent.
JOHN CORRIE MERIVALE, South-Eastern Agricultural College, Wye, Kent.
BRYNMOR THOMAS REES, West of Scotland Agricultural College, Glasgow.
DOUGLAS VERNON RENNIE, University of Edinburgh and East of Scotland College of Agriculture.
ROBERT ROWAT, University of Glasgow and West of Scotland Agricultural College.
LINDLEY STUART BREBNER SCOTT, South-Eastern Agricultural College, Wye, Kent.
REGINALD NEWTON SCOTT, Midland Agricultural College, Sutton Bonington, Loughborough.
HUGH THORPE SIMPSON, South-Eastern Agricultural College, Wye, Kent.
GEORGE STEPHENSON, King's College, Newcastle-upon-Tyne.

ANDREW JOHN KEER STEVEN, University of Glasgow and West of Scotland Agricultural College.

ANDREW STEWART THOMSON, West of Scotland Agricultural College, Glasgow.

ARTHUR MYRUS TOMS, University of Reading.

EXAMINATION AT LEEDS IN JULY.

Diploma.

DENNIS ARCHER, Harper Adams Agricultural College, Newport, Shropshire, and University of Reading.

RICHARD SAMUEL BOYER, Seale Hayne Agricultural College, Newton Abbot, Devon.

ARTHUR BLOODGOOD BRIARS, University of Leeds.

WILLIAM ANTHONY BROWN, Royal Agricultural College, Cirencester.

EDWARD ROBINSON CAPSTICK, King's College, Newcastle-upon-Tyne.

ROBERT CECIL COOPER, University of Reading.

MARTIN ARTHUR CROSS, Harper Adams Agricultural College, Newport, Shropshire.

JOHN TURNER DEATH, Essex Institute of Agriculture, Chelmsford.

PETER GOLD DELINGPOLE, Harper Adams Agricultural College, Newport, Shropshire.

OLIVER JAMES DENYER, South-Eastern Agricultural College, Wye, Kent.

MICHAEL DONCASTER, Midland Agricultural College, Sutton Bonington, Loughborough.

DAVID WILFRED GARRARD, South-Eastern Agricultural College, Wye, Kent.

JOHN HUMPHREY LLOYD GOUCHER, Harper Adams Agricultural College, Newport, Shropshire.

WILLIAM HENRY HELME, University of Reading.

JOHN ARNOLD HOSKIN, Seale Hayne Agricultural College, Newton Abbot, Devon.

WILLIAM JOHNSON, King's College, Newcastle-upon-Tyne.

DAVID LLOYD JONES, Midland Agricultural College, Sutton Bonington, Loughborough.

JOHN THOMAS LAWTON, Midland Agricultural College, Sutton Bonington, Loughborough.

JAMES KEITH MACFARLANE, King's College, Newcastle-upon-Tyne.

FRANK MEGGINSON, University of Leeds.

FRANCIS WILLIAM MORRIS, Harper Adams Agricultural College, Newport, Shropshire.

JACK ARCHIBALD SADLER, Essex Institute of Agriculture, Chelmsford.

HENRY WALTER FRANK SIGGERS, Essex Institute of Agriculture, Chelmsford.

GRAHAM SMITH, Seale Hayne Agricultural College, Newton Abbot, Devon.

HENRY HAROLD WALROND, University of Reading.

LANCELOT MOSLEY WAUD, Midland Agricultural College, Sutton Bonington, Loughborough.

KENNETH HAROLD WELDON, University of Leeds.

JOHN RODHAM WIGHAM, King's College, Newcastle-upon-Tyne.

JAMES ANDREW YOUNG, Essex Institute of Agriculture, Chelmsford.

EXAMINATION PAPERS OF PAST YEARS.

Copies of papers set at past Examinations in AGRICULTURE, so far as available, may be had on application. Price 6d. per set.

Sets of N.D.A. Papers available are those for the years 1937, 1938, 1939, 1940 (April), 1940 (July).

NATIONAL DIPLOMA IN DAIRYING

This Examination, instituted in 1897, is conducted by "The National Dairy Examination Board," appointed jointly by the Royal Agricultural Society of England, the Highland and Agricultural Society of Scotland, and the British Dairy Farmers' Association.

REGULATIONS FOR EXAMINATION IN THE SCIENCE AND PRACTICE OF DAIRYING

EXAMINATION IN 1941.

1. The Societies may hold annually in England and Scotland, under the management of the National Dairy Examination Board appointed by them, one or more examinations for the National Diploma in the Science and Practice of Dairying, on dates and at places from time to time appointed and duly announced; the Diploma to be distinguished shortly by the letters 'N.D.D.'

2. Forms of entry for the Examination in England may be obtained from "The Secretary, Royal Agricultural Society of England, 16 Bedford Square, London, W.C.1." and must be returned to him duly filled up, with the entry fee, on or before 21st July 1941.

3. Forms of entry for the Examination in Scotland may be obtained from "The Secretary, Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh 12," and must be returned to him duly filled up, with the entry fee, on or before 31st July 1941.

4. Any candidate may enter for the Examination either in England or Scotland, but not in both, and a candidate who has once taken part in an Examination in England cannot enter for an Examination in Scotland, or vice versa. *An exception may be made in favour of a candidate reappearing under Regulation 10 (3) provided special application is made at the time of entry.*

5. As a preliminary to the acceptance of any application for permission to enter for the Examination, a candidate must produce:—

(1) from the Head of an approved Dairy Training College or Institute:

(a) a statement that he or she is in possession of the General School Certificate (England), the Day School Certificate Higher (Scotland), or the School Certificate of the Central Welsh Board; or a statement that his or her general education is of an equivalent standard;

- (b) a certificate testifying that he or she has satisfactorily completed courses in (i) soils, crops, rotations, cultivations, manuring of crops (other than pastures), and plant physiology; (ii) elementary chemistry, physics and mechanics, *and*
 - (c) that he or she has also satisfactorily attended a Diploma or Degree course in the subjects of the Examination covering at least two academic years at an approved Dairy Training College or Institute. *This period shall include six months' instruction (consisting of not more than two periods) in practical dairy work.*
 - (d) a certificate of proficiency in soft cheese-making.
- (2) a certificate of proficiency in the milking of cows, signed by a dairy farmer, and evidence that he or she has spent at least six months in not more than two periods on an approved dairy farm and taken part in the work, both in the dairy and on the land. *This period must not run concurrently with the six months' practical training referred to in sub-section 1 (c).*
A Dairy Farm to be approved must have not fewer than fifteen cows in milk.

6. A candidate who has already taken a Degree in Agriculture of a British University, or a Diploma in Agriculture recognised by the National Dairy Examination Board, will be allowed to enter for the National Diploma in Dairying Examination after one year's subsequent training at an approved Dairy Training College or Institute, providing that such course includes at least six months' training in practical dairy work, and that he or she has spent at least six months on an approved dairy farm, and taken part in the work both in the dairy and on the land.

7. In the Examination a candidate will be required to satisfy the Examiners by means of written papers, practical work, and *viva voce*, that he or she has :—

- (1) A general knowledge of the management of a dairy farm, including the rearing and feeding of dairy stock, the candidate being required to satisfy the Examiners that he or she has had a thorough training and practical experience in all the details of dairy work as pursued on a farm.
- (2) A thorough acquaintance with the practical details of the management of a dairy, and the manufacture of butter and cheese, together with a working knowledge of the scientific principles involved in these operations.
- (3) A general knowledge of dairy book-keeping.
- (4) Practical skill in dairying, to be tested by the making of butter and cheese.

NOTE.—A candidate must be prepared to make any one of three varieties of Hard Pressed Cheese, two of which must be Cheddar and Cheshire, these three to be specified on his application form, the Examiner in Cheese-making having the option of saying, during the Examination, which a candidate shall make.

8. Candidates will have the option of :—

- (a) Taking the whole Examination at one time ; or
- (b) Taking the Examination in two parts.

A candidate taking the Examination in two parts must take the following subjects at the first sitting: DAIRY HUSBANDRY, MILK AND MILK PLANT, CREAM AND BUTTER, CHEESE AND CHEESE PRODUCTS, PRACTICAL CHEESE-MAKING AND BUTTER-MAKING; the remaining three Papers, DAIRY CHEMISTRY, DAIRY MICROBIOLOGY, and DAIRY BOOK-KEEPING, at the Examination in the following year.

9. The maximum marks obtainable and the marks required for a pass in each subject are :—

WRITTEN AND ORAL EXAMINATION—		Max.	Pass.
Dairy Husbandry	(3 hours' paper)	150	90
Milk and Milk Plant	(2 hours' paper)	100	60
Cream and Butter	" "	100	60
Cheese and Cheese Products	" "	100	60
Dairy Chemistry	" "	100	60
Dairy Microbiology	" "	100	60
Dairy Book-keeping	" "	100	50
PRACTICAL EXAMINATION—CHEESE-MAKING—			
(a) One of the three Hard Pressed cheeses specified by the candidate on his form of application			
		200	150
(b) Blue-veined			
		100	75
BUTTER-MAKING			
		200	150
		<hr/>	<hr/>
		1250	815

Honours will be awarded to candidates obtaining an aggregate of 80 per cent (1000) of the maximum marks (1250) in the Examination, provided that they also obtain at least 80 per cent (360) of the maximum marks (450) in the Dairy Husbandry, Milk and Milk Plant, Cream and Butter, and Cheese and Cheese Products papers.

10. A candidate taking the whole Examination at one time :—

- (1) who fails in any part of the practical examination shall fail in the whole examination.
- (2) who fails in four or more subjects of the written examination shall fail in the whole examination.
- (3) who, having passed in the practical examination, fails in not more than three subjects of the written examination may, at the discretion of the Board, appear for those subjects in the following year. The Board may in certain circumstances require evidence of further study in those subjects.

11. A candidate taking the Examination in two parts, and failing in a single subject in the first part of the Examination, may, at the discretion of the Board, appear for that subject along with the second part; or, in the case of a single subject of the second part, in the following year. The Board may in certain circumstances require evidence of further study in that subject.

Failure in more than one subject will be regarded as failure in that part of the Examination. Failure in any part of the Practical Examination will entail complete failure.

12. The entrance fees will be as follows :—

For the whole Examination taken at one time	£3	3	0
For the Examination taken in two parts :			
First part	3	3	0
Second part	1	1	0
For reappearance, 10s. 6d. each subject.			

13. The Board reserve the right to postpone, to abandon, and to modify an Examination, and also to decline to admit any particular candidate to the Examination.

DATES OF EXAMINATIONS.

SCOTLAND.—At the Dairy School for Scotland, Auchincruive, Ayr.
WRITTEN—WEDNESDAY, THURSDAY, and FRIDAY, 3rd, 4th and 5th September 1941. **ORAL AND PRACTICAL**—MONDAY, 15th September 1941 and following days. Last date for receiving Applications, THURSDAY, 31st JULY 1941.

ENGLAND.—At the University and British Dairy Institute, Reading.
 WEDNESDAY, 3rd September 1941 and following days. Last date for receiving Applications, MONDAY, 21st July 1941.

SYLLABUS OF SUBJECTS OF EXAMINATION IN 1941.

I.—DAIRY HUSBANDRY.

Buildings of the dairy farm ; structural features, sanitation, and water supply.

Selection, stocking, and equipment of typical dairy farms ; organisation of the dairy farm.

The utilisation of the crops of the dairy farm.

Pastures and pasture management ; dried grass, silage.

Foods used on the dairy farm ; characteristics and relative value.

Live stock of the dairy farm ; essential conformation features of the dairy cow and dairy bull ; British dairy breeds ; milk recording.

Breeding of dairy stock, principles and practice ; selection, care, and management of the sire ; calf rearing ; raising of dairy heifers.

Management of dairy herds ; self-contained herds ; attested herds.

Feeding of dairy cows for milk production ; feeding standards ; construction and use of rations.

Common ailments and diseases of dairy stock ; milk fever, bloat, cow pox, mastitis, contagious abortion, tuberculosis, Johne's disease, sterility, scour, hoose, notifiable animal diseases.

Hygienic milk production ; hand and machine milking ; cleaning and care of milking machines and utensils used in milk production ; milk coolers and farm sterilising equipment.

Pigs on the dairy farm ; suitable breeds for bacon and for pork production ; housing accommodation ; breeding, feeding, and management of pigs ; fattening of pigs ; pig recording ; common ailments and diseases of pigs.

II.—MILK AND MILK PLANT.

Utilisation of milk and milk products in Great Britain ; sources of supply ; the principles of organised marketing. Milk contracts.

Properties of milk.

Variations in the composition of milk ; legal minimum standards for milk ; statutory rules and orders relating to milk and milk products.

Sources of taints and contamination in milk. Abnormal milk. Flavour in milk and the contributing factors.

Grades of milk.

Food value of milk. Hard and soft curd milk.

Transportation of milk ; milk churns ; road and rail tanks ; processing of milk at milk depots ; sampling and testing of milk ; effects of heat on milk ; essentials for efficient pasteurisation ; progressive stages in milk treatment at milk plants ; weighing ; filtering ; clarifying, pumping, pasteurising, cooling, bottling, and capping ; refrigeration ; cold storage.

Disposal of wastes from milk plants.

Distribution of milk.

Special treatment of milk ; homogenisation, irradiation, stassanisation, commercial sterilisation, high temperature, short time heat treatment.

Fermented milk preparations, Yoghurt, Kefir, and cultured butter milk.

Elementary principles of condensing and drying of milk.

III.—CREAM AND BUTTER.

Cream.—Production and consumption of cream in Great Britain. Utilisation of cream ; grades of cream, regulations for the sale of cream ; different methods of obtaining cream from milk.

Operation and management of cream separators, hand and power.

Efficiency of separation ; cleaning and sterilisation of separators.

Testing of cream.

Factors influencing the flavour, physical properties, and keeping qualities of cream ; homogenisation of cream.

Pasteurisation of cream ; cooling and storage ; marketing of cream.

Cream preparations ; whipped cream, clotted cream, sterilised cream, reconstituted cream.

Cream appliances, homogenisers, cream sterilising plant, pasteurisers, cream coolers.

Ice Cream.—Types of plant used. Materials used in, and preparation of mixes. Pasteurising, ripening, freezing, and hardening.

Butter.—Production and consumption of butter in Great Britain ; sources of imports.

Food value of butter ; regulations governing the production and sale of butter.

Selection and grading of cream for butter-making.

Treatment of cream prior to churning ; heating, cooling ; preparation and use of starters.

Churning of cream ; factors affecting churning and loss of butter fat.

Washing of butter ; purity of wash water.

Methods of working and salting of butter ; quality of salt.

Packing of butter and treatment of liners and butter boxes ; storage of butter ; refrigeration in factories and in transport.

Grading and judging butter. National Mark butter. Common defects in butter and their causes.

Special systems of butter-making ; sweet cream butter ; whole milk butter ; neutralised cream butter ; whey butter.

Utilisation of by-products of butter-making ; separated milk and butter milk. Casein.

Butter-making equipment ; separators ; pasteurising plant, cream coolers, cream pumps, starter-preparing apparatus, cream ripeners, churns and butter workers. Butter packers, moulders and blenders, butter cutting, and wrapping machines.

IV.—CHEESE AND CHEESE PRODUCTS.

Production and consumption of cheese in Great Britain ; sources of imports.

Food values of cheese.

Principles of cheese-making ; varieties of cheese.

Hard-pressed cheese. Agents used in manufacturing process ; starter, colour, rennet, salt.

Milk for cheese-making ; care and management.

Detailed knowledge of the manufacture of Cheddar and Cheshire, and one of the following : Derby, Dunlop, Leicester, Gloucester, or Lancashire.

Manufacture of cheese from pasteurised milk.

Small hard-pressed cheeses : Caerphilly, Smallholder, &c.

Difficulties experienced in the manufacturing process ; causes of fast and slow working, gas formation, ropy and slimy whey.

Ripening and storage of cheese.

Grading and judging of cheese ; National Mark standards.

Marketing of cheese.

Defects in the flavour, body, and texture, and in the colour of mature cheese.

Manufacture of Stilton and Wensleydale cheeses, blue-veined and white.

Soft cheese-making.

Cream cheeses. Single and double cream cheeses.

Cheese products. Manufacture of processed cheese, and cheese spreads.

Usual cheese factory equipment and arrangement ; cheese vats,

curd knives, curd agitator, cheese press, curd mill; cheese hoops, cheese turners, paraffining apparatus, pasteurising equipment, air conditioning plant.

Utilisation of whey.

V.—DAIRY CHEMISTRY.

The principal constituents of foodstuffs and the functions they fulfil. Assimilation and digestion. Vitamins.

The nature and composition of milk, colostrum, butter, cheese, cream, separated milk, butter milk, whey, casein, and lactose.

Drying and condensation of milk and milk products.

Variation in composition of milk.

Milk souring, rennet coagulation, preparation and ripening of cheese, storage of butter, salt for dairy purposes.

Metals and their influence on milk and milk products. Taints. Effects of heat on milk. Abnormal milk.

The sampling and analysis of milk and milk products. Freezing point test for milk.

Commercial routine analysis of foodstuffs.

Chemical aspects of water supply.

Dairy detergents and disinfectants.

N.B.—Candidates are required to bring to the Oral Examination in this subject their Laboratory notebooks certified by their teachers as being the record of their Laboratory work carried out during the course.

VI.—DAIRY MICROBIOLOGY.

GENERAL.—The bacteria, yeasts, and moulds which commonly occur in milk and dairy products; their form, classification (in the case of the bacteria—Topley and Wilson's), growth and reproduction. Factors which control rate of growth. Fermentations of importance in dairying; causal micro-organisms and conditions which influence activity.

MILK.—Microbiology of milk production; sources of contamination, their relative importance and organisms derived from them. Normal changes produced by micro-organisms in milk. Abnormal changes; ropiness, premature curdling, gas formation, bitter, yeasty and malty flavours and flavour of roots and feeding-stuffs; causal organisms and methods of prevention. Effects of straining, centrifuging, cooling, heating, condensing, drying, and preservatives on the microflora of milk. Bacteriology of pasteurised and sterilised milk; influence of quality of raw milk. Standards for graded milks.

MILK PRODUCTS.—Starters; their propagation and management. Ripening of cream; development of normal flavour. Microbiology of butter. Ripening of hard, soft, and blue-veined cheese; factors concerned and their control. Microbiology of condensed, dried, and fermented milks. Defects of dairy products, causal organisms and

preventive measures; butter defects—rancidity, yeasty and cheesy flavours, coloured spots; cheese defects—gas formation, bitterness, slow acid development and excessive acidity, colour changes; defects of condensed milk—gas formation, “buttons,” coagulation.

DISEASES.—Diseases which may be conveyed by milk; sources of infection. Bacteriology of tuberculosis, contagious abortion, mastitis and methods of detection. Immunity; vaccines. Disinfection.

WATER.—The importance of a pure water supply for the dairy and the herd. Bacteria commonly present in natural waters. Sources of contamination, the effect of pollution with sewage, water-borne disease.

LABORATORY WORK.—The microscope and its use. Staining (including Gram and Ziehl-Neelsen methods), and microscopic examination of micro-organisms. Methods of isolation and cultivation. Preparation of bile-salt broth, milk, milk agar, and Wilson's agar. Methods for the examination of milk; plate method, post-pasteurisation count, coliform test, Breed's method and the methylene blue reduction, fermentation, acidity and catalase tests. Methods for tracing sources of contamination and of milk faults. Detection of thermophilic, thermoduric, and pathogenic organisms in milk. Examination of water supplies.

N.B.—*Candidates are required to bring to the Oral Examination in this subject their Laboratory notebooks certified by their teachers as being the record of their Laboratory work carried out during the course.*

VII.—DAIRY BOOK-KEEPING.

Reasons for keeping accounts on the farm and in the dairy factory.

General principles of double-entry book-keeping. Use of day-book, journal, ledger, cash-book, and petty-cash book. Preparation of profit and loss account, capital account, and balance-sheet. Adjustments necessary for the owner-occupier.

Analysis cash-book.

Valuations.—Basis of valuations for accounting purposes on the farm and in the dairy factory. Dates for stock-taking.

Methods of accounting suitable for dairy farms with varying systems of milk disposal.

Opening a bank account. Cheques, deposits, and overdrafts.

Assessment of the farmer for Income Tax purposes.

WINNERS OF DIPLOMA IN 1940.**SCOTTISH CENTRE.**

(All the candidates at the Scottish Centre had been students at the Dairy School for Scotland, Auchincruive, Ayr.)

Diploma with Honours.

FRANCIS ERIC MOON, 75 Hutton Avenue, West Hartlepool, Co. Durham.

Diploma.

EVELYN BEWICK, Rectory Farm, Arkleby, Aspatria, Cumberland.

HUGH REGINALD BIRKS, The Rigg, Arkengarthdale, Richmond, Yorks.

ELMA HALLIDAY WATSON BUCHANAN, Glen Annan, Lockerbie, Dumfriesshire.

DUNCAN WILLIAM CUNNINGHAM, Kinbuck Schoolhouse, Dunblane, Perthshire.

MARY JANE STEPHEN DUNCAN, Muirton Mains, Fairburn, Muir-of-Ord, Ross-shire.

CATHERINE ISABELLA MARGARET FINLAYSON, Wester Kerse of Boquhapple, Thornhill, by Stirling.

ANNIE GIBSON, Forss, Thurso, Caithness.

CATHERINE ARMOUR GILCHRIST, East Trodical Farm, Machrihanish, by Campbeltown, Kintyre, Argyll.

GOPAL GOPINATH, "Gopivilas," Kottayam, Travancore, India.

CHRISTINE JEAN GORDON, Wellheads, Huntly, Aberdeenshire.

ROBERT M'INTYRE GREENSHIELDS, 85 Gatehouse Street, Shettleston, Glasgow, E.2.

IAN ALLISON MACFARLANE, 8 Broadstone Avenue, Port Glasgow, Renfrewshire.

WILLIE METCALFE, Low Farm, Grimethorpe, Barnsley, Yorks.

ANNIE MARGARET MILLER, Old Stirkoke, Wick, Caithness.

RITA THOMPSON PEACOCK, Whickham Hill Farm, Dunston-on-Tyne, Gateshead, 11, Co. Durham.

JEAN FRASER PRENTICE, Bogside Farm, Carlisle, Lanarkshire.

ISABEL ARCHIBALD DUNCAN REID, Lundie Farm, Doun, Perthshire.

ROBERT ROWAT, 50 Dundrennan Road, Glasgow, S.2.

ROBERT AIKMAN RUSSELL, 41 Frankfort Street, Glasgow, S.1.

JOHN A. SEED, Lily Bank, Wetherby Road, Knaresboro', Yorks.

ALICE EUPHEMIA SWAN SIMPSON, 2 Claremont Gardens, Leith.

DORIS CAMPBELL STEVENSON, "Craigengower," Coynton, Ayr.

CHARLES LUMSDEN THOM, The Schoolhouse, Newton Mearns, Renfrewshire.

ENGLISH CENTRE.*Diploma with Honours.*

MARGARET HARTNELL BAKER, The University and British Dairy Institute, Reading.

MARJORIE BRINDLEY, Midland Agricultural College, Sutton Bonington, Loughborough.

Diploma.

- MARGERY ABBOTT, The University and British Dairy Institute, Reading.
- JOHN METHUEN ADAMS, The University and British Dairy Institute, Reading.
- GEORGE BACON, Midland Agricultural College, Sutton Bonington, Loughborough.
- MARGARET WINIFRED BEARE, The University and British Dairy Institute, Reading.
- RICHARD EARL BLAKE, The University and British Dairy Institute, Reading.
- MARY PHILLIS BREAY, Lancashire Institute of Agriculture, Hutton, Preston.
- BEATRICE JOYCE BURDITT, Midland Agricultural College, Sutton Bonington, Loughborough.
- ELIZABETH EMILY CREED, The University and British Dairy Institute, Reading.
- ESTHER MARY DAVIES, University College of Wales, Aberystwyth, and British Dairy Institute, Reading.
- MARY KATHLEEN DAVIES, University College of Wales, Aberystwyth.
- JOHN E. DELMER, East Anglian Institute of Agriculture, Chelmsford.
- NAUREN KUMAR DUTT, The University and British Dairy Institute, Reading.
- MARGARET GRACE GOODWIN, East Anglian Institute of Agriculture, Chelmsford, and British Dairy Institute, Reading.
- ELEANOR GREEN, University College of Wales, Aberystwyth, and British Dairy Institute, Reading.
- WILLIAM HENRY HELME, The University and British Dairy Institute, Reading.
- PHILIP HICKEN, Midland Agricultural College, Sutton Bonington, Loughborough.
- MARY MURIEL HOULDER, The University and British Dairy Institute, Reading.
- OLIVE GRACE ELIZABETH HOWARD, The University and British Dairy Institute, Reading.
- MELITA GRACE HUGHES, University College of Wales, Aberystwyth.
- MAIR LLOYD, University College of Wales, Aberystwyth, and British Dairy Institute, Reading.
- MARY ENID ANN LLOYD, University College of Wales, Aberystwyth.
- DOREEN MITCHELL, Midland Agricultural College, Sutton Bonington, Loughborough.
- JEAN ADELINE MITCHELL, Studley College, Warwickshire.
- JOAN ELIZABETH MYERSCOUGH, Lancashire Institute of Agriculture, and University and British Dairy Institute, Reading.
- MARY AGNES NELSON, Lancashire Institute of Agriculture, Hutton, Preston.
- MARY GEORGINA PEAK, Studley College, Warwickshire.
- MARY ELIZABETH PHILLIPS, The University and British Dairy Institute, Reading.
- CYNTHIA MARY PRATT, The University and British Dairy Institute, Reading.
- BRENDA PULLIN, East Anglian Institute of Agriculture, Chelmsford, and British Dairy Institute, Reading.

JOHN GRAHAM RICHARDSON, Lancashire Institute of Agriculture,
Hutton, Preston.

HAROLD ERNEST RILEY, Midland Agricultural College, Sutton
Bonington, Loughborough, and British Dairy Institute, Reading.

MAIR ROBERTS, The University and British Dairy Institute, Reading.

ISMAIL SIRRY, The University and British Dairy Institute, Reading.

GRAHAM SMITH, Seale Hayne Agricultural College, Newton Abbot,
Devon.

FREDA MAY SUMNER, The University and British Dairy Institute,
Reading.

AUSTIN THOMAS, University College of Wales, Aberystwyth.

JAMES EDWARD TRISTRAM, Midland Agricultural College, Sutton
Bonington, Loughborough.

BARBARA ANNE WALLACE, Studley College, Warwickshire.

CECIL RAY WATERS, Midland Agricultural College, Sutton Bonington,
Loughborough.

EDITH WITHERS, The University and British Dairy Institute, Reading.

EXAMINATION PAPERS OF PAST YEARS.

Copies of papers set at past Examinations in Dairying may be had on application. Price 6d. per set. Papers available are those for the years 1937-1940 inclusive.

CERTIFICATES IN FORESTRY

In 1870 the Society instituted an Examination in Forestry, and granted First and Second-Class Certificates respectively to such students as attained a certain standard of proficiency in the following subjects. Candidates were required to possess a thorough acquaintance with the theory and practice of Forestry, and a general knowledge of the following branches of study, so far as these applied to Forestry: (a) the elements of Forest Botany and Forest Zoology; (b) the elements of Meteorology and Geology; (c) Forest Engineering; and (d) Arithmetic and Book-keeping.

Holders of the First-Class Certificate were entitled to become free Life Members of the Society.

In view of the institution of Examinations for Certificates and Diplomas in Forestry by the Royal Scottish Forestry Society, and by arrangement with that Society, the Board of Directors of the Highland and Agricultural Society of Scotland resolved in 1935 to cease holding further Examinations for the First and Second-Class Certificates, and that, in future, the granting of Certificates and Diplomas be left in the hands of the Royal Scottish Forestry Society.

The list of students who obtained the Highland and Agricultural Society's Certificates in Forestry prior to 1899 appears in the 'Transactions' for the year 1899. A further list of those obtaining Certificates between 1899 and 1935 inclusive appears in the 'Transactions' for the year 1935. The total number of Certificates granted since the commencement of the Examination in 1870 was as follows: First-Class, 43; Second-Class, 38.

VETERINARY CERTIFICATES AND MEDALS

The Society established a Veterinary Department in 1823, but by an arrangement made with the Royal College of Veterinary Surgeons, the Society's examination ceased in 1881. Holders of the Society's Veterinary Certificate are entitled to become members of the Royal College of Veterinary Surgeons on payment of certain fees, without being required to undergo any further examination. The number of students who passed for the Society's Certificate is 1183.

The Society gives annually a limited number of silver medals for Class competition to each of the two Veterinary Colleges in Scotland—the Royal (Dick) Veterinary College, Edinburgh, and the Glasgow Veterinary College, Glasgow.

CHEMICAL DEPARTMENT

Chemist to the Society—J. F. TOCHER, D.Sc., LL.D., F.I.C.,
Crown Mansions, 41½ Union Street, Aberdeen.

The object of the Chemical Department is to promote the diffusion of a knowledge of Chemistry as applied to agriculture among the members of the Society, to carry out experiments for that purpose, to assist members who are engaged in making local experiments requiring the direction or services of a chemist, to direct members in regard to the use of manures and feeding-stuffs, to assist them to put the purchase of these substances under proper control, and in general to consider all matters coming under the Society's notice in connection with the Chemistry of Agriculture.

MEMBERS' PRIVILEGES IN RESPECT TO ANALYSES.

The Directors are anxious to take any steps in their power to expose the vendors of inferior fertilisers and feeding-stuffs, and the members can give them assistance in this by supplying to the Chemist, when sending samples for analysis, information as to the guarantee, if any, on which the goods were sold, and also as to the price charged.

These charges apply only to analyses made for agricultural purposes, and for the sole and private use of members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed.

Valuations of manures, according to the Society's scale of units, will be supplied if requested.

The Society will not be liable for payment of fees in respect of analyses for any member in excess of £5 for any one year, or £10 for any five consecutive years.

The undernoted fees are those payable by a member. These amounts represent only one-third of the total fee for any particular analysis, the other two-thirds being paid by the Society.

This scale does not apply to members whose subscriptions are in arrears.

FERTILISERS AND FEEDING-STUFFS.

- | | |
|---|------|
| (1) The determination of one ingredient in a single sample of a <i>manure</i> or of a <i>feeding-stuff</i> | 3/6 |
| (2) The determination of two ingredients in a single sample of a <i>manure</i> or of a <i>feeding-stuff</i> | 5/- |
| (3) The complete analysis of a sample of a <i>manure</i> or of a <i>feeding-stuff</i> | 10/- |

For example—

For one ingredient only.

Linseed and other cakes, for oil or for albuminoids . . .	} 3/6
Feeding meals, ground cereals, for oil or for albuminoids . . .	
Bone meals, for nitrogen or for total phosphate . . .	
Compound manures, for nitrogen or for soluble phosphate or for insoluble phosphate or for potash . . .	
Superphosphate, for soluble phosphate or for insoluble phosphate . . .	
Ground mineral phosphate, for insoluble phosphate or for citric soluble phosphate . . .	
Slag phosphate, for insoluble phosphate or for citric soluble phosphate . . .	

For two ingredients only.

Any two ingredients of a manure or of a feeding-stuff . . .	5/-
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For a complete analysis.

For manures, the proportions of nitrogen (nitrogen included as nitrates or as ammonia compounds), soluble phosphate, insoluble phosphate, potash ; For feeding-stuffs, the proportions of oil, albuminoids, carbohydrates, iodine, mineral matter, fibre and moisture . . .	10/-
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(4) Ground Limestone, for carbonic acid and calcium, two determinations . . .	5/-
(5) Ground Lime, for percentage of calcium oxide . . .	3/6

AGRICULTURAL PRODUCTS.

(6) Turnips, sugar beet, for total sugar . . .	5/-
(7) Turnips, sugar beet, for oil, albuminoids, sugar, mineral matter, fibre and moisture . . .	10/-
(8) Grass, hay, ensilage, grain, &c., for oil, albuminoids, carbohydrates, mineral matter, fibre and moisture . . .	10/-
(9) Grain, for carbohydrates and moisture . . .	5/-

MILK AND MILK PRODUCTS.

(10) Milk, fresh, for butter fat only, by Gerber process . . .	1/-
(11) Milk, fresh, for butter fat, by Gerber, and solids not fat . . .	2/6
(12) Milk, sour sample, for butter fat, and solids not fat. Seshlet extraction and Government Laboratory method for sour sample . . .	5/-
(13) Milk, for preservatives, borates, sulphur dioxide, hydrogen peroxide, formalin . . .	5/-
(14) Butter, for true butter fat and moisture (Reichert), for genuineness . . .	5/-
(15) Butter, for true butter fat (Reichert), moisture, foreign fat, preservatives . . .	7/6

WATER AND LIQUID SUBSTANCES.

Cases containing bottles for water samples and instructions for sampling are sent from the laboratory on application.

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|--|------|
| (16) Supply of water at farm, for total solids, free ammonia, albuminoid ammonia, nitrites, nitrates, hardness, for fitness for domestic use or potability . . . | 12/6 |
| (17) Supply of water at farm, for potability as above, and for proportions of mineral constituents, lead, copper, acidity pH value, action of water on lead (plumbo solvenoy), action of water on copper . . | £1 |
| (18) Farm-yard manure, liquid manure, for nitrogen, potash, phosphates, and proportion of other mineral substances | £1 |

MISCELLANEOUS.

- | | |
|---|---------|
| (19) Feeding oils and fats, for composition and quality . . . | 10/- |
| (20) Search for proportion of arsenic in feeding-stuff . . . | 10/- |
| (21) Search for proportion of lead in feeding-stuff . . . | 10/- |
| (22) Search for arsenic or any one poison in feeding-stuff . . . | 10/- |
| (23) Search for proportion of any one poison in viscera . . . | 10/- |
| (24) Search for poisons in food or in viscera, and proportion of poison found | £1 10/- |

(Veterinary surgeons are not entitled to have searches made for poisons in food or viscera under the Society's scheme for clients who are not members of the Society.)

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|--|------|
| (25) Proportion of arsenic in sheep dips or insecticides . . . | 10/- |
| (26) Proportion of carbolic acid in sheep dips or insecticides . . | 5/- |
| (27) Proportion of tar acids in sheep dips or insecticides . . . | 10/- |
| (28) Insecticides, foot rot pastes and other agricultural remedies for live stock and farm produce . . . | £1 |

Samples should be sent (carriage paid) to Dr J. F. TOCHER, Crown Mansions, 41½ Union Street, Aberdeen.

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

MANURES.

Any method of sampling mutually agreed upon between buyer and seller may be adopted, but the following method is recommended as a very complete and satisfactory one: Four or more bags should be selected for sampling. Each bag is to be emptied out separately on a clean floor, worked through with the spade, and one spadeful taken out and set aside. The four or more spadefuls thus set aside are to be mixed together until a uniform mixture is obtained. Of this mixture one spadeful is to be taken, spread on paper, and still more thoroughly mixed, any lumps which it may contain being broken down with the hand. Of this mixture two samples of about half a pound each should be taken by the purchaser or his agent, in the presence of the seller or his agent or two witnesses (due notice having been given to the seller of the time and place of sampling), and these

samples should be taken as quickly as possible, and put into bottles or tin cases to prevent loss of moisture, and having been labelled, should be sealed by the samplers—one or more samples to be retained by the purchaser, and one to be sent to the Chemist for analysis.

FEEDING-STUFFS.

Samples of feeding-stuffs which are in the form of meal may be taken in a similar manner to that mentioned above.

Samples of cake should be taken by selecting four or more cakes from the bulk. These should be nudded to a size not larger than walnuts. The nudded cake should then be thoroughly mixed and samples of not less than one pound each taken from it. The samples should be put into bottles or tins, sealed up, and labelled. One sample should be sent to the Chemist, and one or more duplicates retained by the purchaser.

VEGETABLE PRODUCTS.

Turnips, &c., at least 50 bulbs carefully selected as of fair average growth.

Hay, straw, ensilage, &c., should be sampled from a thin section cut across the whole stack or silo, and carefully mixed; above 2 lb. weight is required for analysis.

Grain should be sampled like manures.

Grass should be representative of the whole field; about 5 lb. weight is required for analysis.

DAIRY PRODUCE.

Milk.—Samples of milk from individual cows should be taken direct from the milk-pail after complete milking. Average samples from a number of cows should be taken immediately after milking. Specify whether the sample is morning or evening milk, or a mixture of these. Samples to be tested for adulteration should not be drawn from the bottom or taken from the top of standing milk, but they should be ladled from the vessel after the milk has been thoroughly mixed. Samples of milk should be sent immediately to the Chemist.

For most purposes a half-pint bottle of milk is a large enough sample.

Butter.—About quarter-pound samples are required.

WATERS.

When the water is from a well, it should be pumped for some minutes before taking the sample.

If the well has been standing unused for a long time, it should be pumped for some hours, so that the water may be renewed as far as possible.

If the well has been newly dug or cleaned out, it should be pumped as dry as possible, daily, for a week before taking the sample.

Water from cisterns, tanks, ponds, &c., should be sampled by immersing the bottle entirely under the water, and holding it, neck

upwards, some inches below the surface. *Water from the surface should not be allowed to enter the bottle.*

Spring or stream water should not be sampled in very wet weather, but when the water is in ordinary condition. Such waters should be sampled by immersing the bottle. If not deep enough for that purpose, a perfectly clean cup should be used for transferring the water to the bottle.

When the bottle has been filled the stopper should be rinsed in the water before replacing it.

Interference with or disturbance of wells or springs, or the ground in their immediate vicinity, must be carefully avoided during sampling, and for at least twenty-four hours before it.

After a sample has been taken, it should be sent to the Chemist as speedily as possible.

A description of the source and circumstances of the water should accompany the sample, as the interpretation of the analytical results depends to some extent on a knowledge of such particulars.

N.B.—Stone jars and old wine bottles are unsuitable for conveying samples. Winchester quarts chemically cleaned should be obtained from Dr J. F. TOCHER, Crown Mansions, 41½ Union Street, Aberdeen.

COMPOSITION AND CHARACTERISTICS OF MANURES AND FEEDING-STUFFS.

Note on Statutory Statements.

In the Fertilisers and Feeding Stuffs Act, 1926, are included certain schedules which give the definitions implied on the sale of fertilisers and feeding-stuffs under certain names and also the particulars to be contained in the statutory statement which has to be furnished to the purchaser in connection with the sale of a fertiliser or a feeding-stuff. Such statutory statements "shall have effect as a written warranty by the seller that the particulars contained in the statutory statement are correct."

The particulars required vary for different articles and the under-noted are given as examples. Full particulars can be found by reference to the schedules of the Act.

FERTILISERS.

Sulphate of ammonia	. . .	Amount of nitrogen and amount of free acid.
Superphosphate	. . .	Amount of soluble phosphoric acid.
Potassium salts (potash fertilisers)		Amount of potash.
Compound fertilisers	. . .	Amounts of nitrogen, potash, soluble phosphoric acid, and insoluble phosphoric acid, if any, respectively.

FEEDING-STUFFS.

Linseed cakes and the meals of such cakes.		Amounts of oil and albuminoids.
Cotton cakes or meals (not decorticated).		Amounts of oil and albuminoids.
Cotton cakes or meals from decorticated or partly decorticated cotton seed.		Amounts of oil, albuminoids, and fibre.
Compound cakes or meals .	. . .	Amounts, if any, of oil, albuminoids, and fibre.

PRICES OF FERTILISERS AND FEEDING-STUFFS— SEASON 1941.

(Cash Prices as at 5th February. These prices are subject to variation from month to month or oftener.)

SUPERPHOSPHATES.

ITEM TO BE VALUED.	PRICES FOR THE UNDERNOTED PERCENTAGES.		
	16·0 35	18·0 39·3	21·0 45·9
PHOSPHORIC ACID DISSOLVED =TRICALCIUM PHOSPHATE DISSOLVED			
February Price per ton	£4 19 0	£5 4 0	£5 11 6
Price per Unit	6/2½	5/9½	5/3½

FERTILISERS.

(Other than Superphosphates.)

Name of Fertiliser.	Guarantee.	Price per Ton.	Price per Unit.
Sulphate of Ammonia (neutral)*	20·6 % Nitrogen	£ s. d. 10 0 6	s. d. 9 8½
„ „ (March-June)	12 % „	10 2 0	9 9½
Basic Slag †	12 % Total Phos. Acid =26·2 % Tric. Phos.	2 10 9	4 2½
„ „ †	13 % Total Phos. Acid =28·4 % Tric. Phos.	2 12 9	4 0½
„ „ †	14 % Total Phos. Acid =30·6 % Tric. Phos.	2 14 9	3 11
Bone Meal (Indian)	4 % Nit. 20 % Total Phos. Acid =43·7 % Tric. Phos.	12 10 0	N 27 9 TPA 6 11½
Steamed Bone Flour	1 % Nit. 30 % Total Phos. Acid =65·5 % Tric. Phos.	9 5 0	N 21 9 TPA 5 5½
Ground Mineral Phosphate §	28 % Total Phos. Acid =61·1 % Tric. Phos.	4 16 0	3 5½
Nitrate of Soda (at Leith)	16 % Nitrogen	10 17 8	13 7½
Nitro Chalk *	15·5 % „	9 14 0	12 6½
Potash Salts	30 % Potash	7 3 6	4 9½
Sulphate of Potash	48·5 % „	18 15 0	7 8½
Muriate of Potash	50 % „	11 10 0	4 7½
Concentrated Fertiliser **	14 % Nitrogen 14 % Sol. P.A. 10 % Potash	15 12 6	N 11 3 SPA 7 0½ Pot. 5 7½

The prices for all fertilisers are cash prices for two-ton lots in bags at Leith or Glasgow, unless otherwise stated. Where prices are quoted carriage paid, there is a reduction, in certain cases, of from 5/- to 10/- per ton when lifted Ex Sellers' stores.

* Carriage paid to any railway station in six-ton lots. Four-ton lots 1/- more per ton.

† Manufacturers' allowance as adjusted with the Land Fertility Committee—viz., 1/- per ton on all grades up to and including 12%; over 12% up to and including 15·75%, 2/- per ton; over 15·75%, 3/- per ton.

‡ The fineness is such that 80% of the powder will pass through the prescribed sieve.

§ The fineness is such that 90% of the powder will pass through the prescribed sieve.

** Price for 6 ton lots including cost of mixing, &c.

N.B.—When these units are multiplied by the percentages in the analysis of a Manure, they will produce a value representing very nearly the cash price per ton at which TWO TONS may be bought in fine serviceable condition at Leith or Glasgow. Larger purchases may be made on more favourable terms.

INSTRUCTIONS FOR VALUING MANURES.

The unit used for the valuation of manures is the hundredth part of a ton, and as the results of analyses of manures are expressed in parts per hundred, the percentage of any ingredient of a manure when multiplied by the price of the unit of that ingredient represents the value of the quantity of it contained in a ton.

As an example take muriate of potash; a good sample (see p. 45) will be guaranteed to contain 50 per cent of oxide of potash. All potash manures are valued according to the amount of potash (oxide of potash) they yield, and muriate of potash yields 50 per cent of potash (K_2O)—i.e., 50 units per ton; and as a ton of muriate of potash costs £11, 10s., the price of the unit is the fiftieth part of that—viz., $4/7\frac{1}{2}$. If on analysis a sample of muriate of potash guaranteed to contain 50 per cent of potash is found to contain only 47 per cent, the price per ton will be $13/10$ (three times $4/7\frac{1}{2}$) less—viz., £10, 16s. 2d.

Similarly with all other manures, the price per unit is derived from the price per ton of a sample of good material up to its guarantee, and therefore the proper price per ton of a manure is found by multiplying the price of the unit of the valuable ingredient by the percentage as found by analysis. If a manure contains more than one valuable ingredient, the unit value of each ingredient is multiplied by its percentage, and the values so found when added together give approximately the price per ton of the manure.

Nitrate of soda contains no ammonia, but it contains nitrogen, and 14 units of nitrogen are equivalent to 17 units of ammonia.

The commercial values of manures are determined by means of the UNITS in the following manner:—

Take the results of analysis of the manure, and look for the following substances:—

Phosphates dissolved (or soluble phosphoric acid)

Phosphates undissolved (or insoluble phosphoric acid)

Total phosphoric acid

Nitrogen

Potash

No other items but these are to be valued.

Should the results of analysis or the guarantee not be expressed in that way, the chemist or the seller should be asked to state the quantities in these terms.

Suppose the manure is ground mineral phosphate—

The proportion of phosphate present in a sample guaranteed to contain 28 per cent phosphoric acid may be 26 per cent phosphoric acid. The price per unit of phosphoric acid in ground mineral phosphate (28 per cent grade) is 3s. $5\frac{1}{2}$ d. The value of ground mineral phosphate containing 26 per cent phosphoric acid is therefore 26 times 3s. $5\frac{1}{2}$ d., equal to £4, 9s. 2d.

Suppose the manure is a superphosphate—say an ordinary superphosphate, 17 per cent soluble phosphoric acid,—the price per unit of phosphoric acid in superphosphate (18 per cent grade) is $5/9\frac{1}{2}$.

It is valued thus—

Soluble phosphoric acid. 17 times $5/9\frac{1}{2}$, equal to £4, 18s. 1d.

Insoluble phosphoric acid is not valued in a superphosphate.

Suppose the manure is a compound fertiliser containing 4 per cent nitrogen, 7 per cent soluble phosphoric acid, 3 per cent insoluble phosphoric acid, and 4 per cent potash. From the units given on p. 46 for "Mixtures and Compound Manures," the value of this compound fertiliser is obtained as follows :—

The value of the—

Nitrogen will be	£1	19	4	per ton
Soluble phosphoric acid will be	2	3	2	„
Insoluble phosphoric acid will be	0	13	4	„
Potash will be	0	19	8	„

£5 15 6

The value of this manure will thus be £5, 15s. 6d. per ton, exclusive of the cost of mixing, bags and bagging, which may be taken on an average at about 29/6 per ton. It will be seen that the potash is valued on the assumption that it is derived from muriate.

Note.—The units have reference solely to the MARKET PRICES of MANURES, and not to their AGRICULTURAL VALUES.

TABLE OF COMPENSATION VALUES FOR 1941.

TABLE SHOWING THE VALUE OF FEEDING-STUFFS AS MANURE PER TON, AND THE COMPENSATION VALUE PER TON OF FOOD CONSUMED, BASED ON THE AVERAGE UNIT PRICES OF FERTILISERS FOR 1941.

The following is a Table showing (under Section A) the average proportions of nitrogen, phosphoric acid, and potash present in the feeding-stuffs named. The Table also shows the value per unit of nitrogen, phosphoric acid, and potash, the prices per unit being the value per unit for compound manures prevailing for 1941. Under Section B of the Table is shown the compensation value per ton of food consumed for each of the feeding-stuffs named, based on the unit prices for 1941. Column (1) of Section B of the Table shows the value per ton recovered in dung; while the remaining two columns show the residual values per ton after one crop and two crops have been removed.

The residual value, after one crop has been removed, is taken as one-half of the original residual value. Residual values, after one crop has been removed, are reduced by one-half after each crop.

Foods.	Nitrogen.		
	Per cent in food.	Value at 0s. 10d. per unit.	Two-fifths value to manure.
	(1)	(2)	(3)
Cotton-cake, decorticated	6.90	s. d. 67 10	s. d. 27 2
Cotton-cake, undecorticated	3.54	34 10	13 11
Linseed-cake	4.75	46 9	18 8
Linseed	3.60	35 5	14 2
Soya-bean cake	6.85	67 4	26 11
Palu-nut cake	2.50	24 7	9 10
Cocoa-nut cake	3.40	33 5	13 4
Earth-nut cake	7.62	74 11	30 0
Rape cake	4.80	48 2	19 3
Beans	4.00	39 4	15 9
Peas	3.60	35 5	14 2
Wheat	1.80	17 8	7 1
Barley	1.65	16 3	6 6
Oats	2.00	19 8	7 10
Maize	1.70	16 9	6 8
Rice-meal	1.90	18 8	7 6
Locust beans	1.20	11 10	4 9
Malt	1.70	16 9	6 8
Malt culms	3.90	38 4	15 4
Bran	2.50	24 7	9 10
Brewers' and distillers' grains (dried)	3.80	32 5	13 0
Brewers' and distillers' grains (wet)	0.81	8 0	3 2
Dried distillery dreg	5.81	52 3	20 11
Clover hay	2.24	22 0	8 10
Meadow hay	1.50	14 9	5 11
Wheat straw	0.45	4 5	1 9
Barley straw	0.40	3 11	1 7
Oat straw	0.50	4 11	2 0
Mangolds	0.22	2 2	0 10
Swedes	0.25	2 6	1 0
Turnips	0.18	1 9	0 8
Fish-meal	8.98	88 4	35 4

The figures in column (10) are the

A. VALUE PER TON AS MANURE.						B. COMPENSATION VALUE PER TON OF FOOD CONSUMED.		
Phosphoric Acid.			Potash.			(1) Value re- covered in dung.	Residual Value after	
Per cent in food.	Value at 6s. 2d. per unit.	Three- fourths value to manure.	Per cent in food.	Value at 4s. 11d. per unit.	Three- fourths value to manure.	(10)	(2) One crop.	(3) Two crops.
(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	s. d.	s. d.		s. d.	s. d.	s. d.	s. d.	s. d.
3.10	19 1	14 4	2.00	9 10	7 5	48 11	24 6	12 3
2.00	12 4	9 3	2.00	9 10	7 5	30 7	15 4	7 8
2.00	12 4	9 3	1.40	6 11	5 2	33 1	16 7	8 3
1.54	9 6	7 2	1.37	6 9	5 1	26 5	13 3	6 7
1.30	8 0	6 0	2.20	10 10	8 2	41 1	20 7	10 3
1.20	7 5	5 7	0.50	2 6	1 11	17 4	8 8	4 4
1.40	8 8	6 6	2.00	9 10	7 5	27 3	13 8	6 10
2.00	12 4	9 3	1.50	7 5	5 7	44 10	22 5	11 3
2.50	15 5	11 7	1.50	7 5	5 7	36 5	18 3	9 1
1.10	6 9	5 1	1.30	6 5	4 10	25 8	12 10	6 5
0.85	5 3	3 11	0.96	4 9	3 7	21 8	10 10	5 5
0.85	5 3	3 11	0.53	2 7	1 11	12 11	6 6	3 3
0.75	4 8	3 6	0.55	2 8	2 0	12 0	6 0	3 0
0.60	3 8	2 9	0.50	2 6	1 11	12 6	6 3	3 2
0.60	3 8	2 9	0.37	1 10	1 5	10 10	5 5	2 9
0.60	3 8	2 9	0.37	1 10	1 5	11 8	5 10	2 11
0.80	4 11	3 8	0.80	3 11	2 11	11 4	5 8	2 10
0.80	4 11	3 8	0.60	2 11	2 2	12 6	6 3	3 2
2.00	12 4	9 3	2.00	9 10	7 5	32 0	16 0	8 0
2.70	16 8	12 6	1.45	7 2	5 5	27 9	13 11	6 11
1.61	9 11	7 5	0.20	1 0	0 9	21 2	10 7	5 4
0.42	2 7	1 11	0.05	0 3	0 2	5 3	2 8	1 4
0.44	2 9	2 1	0.22	1 1	0 10	23 10	11 11	6 0
0.57	3 6	2 8	1.50	7 5	5 7	17 1	8 7	4 3
0.40	2 6	1 11	1.60	7 10	5 11	13 9	6 11	3 5
0.24	1 6	1 2	0.80	3 11	2 11	5 10	2 11	1 0
0.18	1 1	0 10	1.00	4 11	3 8	6 1	3 1	1 6
0.24	1 6	1 2	1.00	4 11	3 8	6 10	3 5	1 9
0.07	0 5	0 4	0.40	2 0	1 6	2 8	1 4	0 8
0.06	0 4	0 3	0.22	1 1	0 10	2 1	1 1	0 6
0.05	0 4	0 3	0.30	1 6	1 2	2 1	1 1	0 6
7.24	44 8	33 6	0.50	2 6	1 11	70 9	35 5	17 8

sum of columns (3), (6), and (9).

BOTANICAL DEPARTMENT

Consulting Botanist to the Society—(vacant).

The Society has fixed the following scale of charges for the examination of plants and seeds for the *bona fide* and individual use and information of members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination required, and to quote its number as appearing in the undernoted Scale of Charges. The charge for examination must be paid at the time of application, and the carriage or postage on all parcels must be prepaid.

Scale of Charges for Examinations.

1. A report on the purity, amount, and nature of foreign materials, and the germinating power of a sample of seed 1s.
2. Determination of the species of any weed or other plant, or of any vegetable parasite, with a report on its habits and the means for its extermination or prevention 1s.
3. Report on any disease affecting farm crops 1s.
4. Determination of the species of any natural grass or fodder plant, with a report on its habits and pasture or feeding value 1s.

The Consulting Botanist's Reports are furnished to enable members—purchasers of seeds and corn for agricultural or horticultural purposes—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes by seedsmen or otherwise.

Purchase of Seeds.

The purchaser should obtain from the vendor, by invoice or other writing, the proper designation of the seeds bought, with a guarantee of the percentage of purity and germination, and of its freedom from ergot, and in the case of clover, from the seeds of dodder or broomrape.

It is strongly recommended that the purchase of *prepared mixtures* of seeds should be avoided. The different seeds should be purchased separately and mixed by the farmer: mixtures cannot be tested for germination.

The Sampling of Seeds.

The utmost care should be taken to secure a fair and honest sample. This should be drawn from the bulk delivered to the purchaser, and not from the sample sent by the vendor.

When legal evidence is required, the sample should be taken from the bulk, and placed in a sealed bag in the presence of a witness. Care should be taken that the sample and bulk be not tampered with after delivery, or mixed or brought in contact with any other sample or bulk.

At least one ounce of grass and other small seeds should be sent, and two ounces of cereals and the larger seeds. When the bulk is obviously impure the sample should be at least double the amount specified. Grass seeds should be sent at least four weeks, and seeds of clover and cereals two weeks, before they are to be used.

The exact name under which the sample has been sold and purchased should accompany it.

Reporting the Results.

The Report will be made on a schedule in which the nature and amount of impurities will be stated, and the number of days each sample has been under test, with the percentage of the seeds which have germinated.

"Hard" clover seeds, though not germinating within the time stated, will be considered good seeds, and their percentage separately stated.

The impurities in the sample, including the chaff of the species tested, will be specified in the schedule, and only the percentage of the pure seed of that species will be reported upon; but the REAL VALUE of the sample will be stated. The Real Value is the combined percentages of purity and germination, and is obtained by multiplying these percentages and dividing by 100: thus in a sample of Meadow Fescue having 88 per cent purity and 95 per cent germination, 88 multiplied by 95 gives 8360, and this divided by 100 gives 83·6, the Real Value.

Selecting Specimens of Plants.

The whole plant should be taken up and the earth shaken from the roots. If possible the plants should be in flower or fruit. They must be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. They must be placed in a bottle, or packed in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

NOTE.—Members are reminded that Seeds may now be tested at the Department of Agriculture for Scotland Seed-testing Station. Samples should be addressed to T. Anderson, Esq., Seed-testing Station, East Craigs, Corstorphine, Edinburgh.

ENTOMOLOGICAL DEPARTMENT

Consulting Zoologist to the Society—A. E. CAMERON, M.A., D.Sc.,
Department of Agricultural and Forest Zoology, University of
Edinburgh, 10 George Square, Edinburgh.

REPORTS ON THE ANIMAL ENEMIES OF CROP PLANTS AND LIVE STOCK (INCLUDING POULTRY).

The Consulting Zoologist is prepared to send to any Member of the Society a Report on damage to, or diseases of, plants and animals due to animal agency (Insects, Mites, Worms, Snails, Slugs, Birds, and the Smaller Mammals), and will advise Members regarding insects or allied animals which, in any stage of their development, infest—

- | | |
|-----------------------------------|-------------------------------------|
| (a) Farm crops. | (d) Fruit and fruit trees. |
| (b) Stored grain and foodstuffs. | (e) Forest trees and stored timber. |
| (c) Garden and greenhouse plants. | (f) Live stock (including poultry). |

Any Member consulting Dr Cameron should give him full particulars of the damage or disease upon which his advice is desired. In addition, there should be sent to him specimens of the injured plants, or the injured parts of plants, &c., as well as specimens of the insects or animals believed to be the cause of the injury.

Specimens should be sent in tin or wooden boxes, or in quills, in order to prevent injury in transmission.

The Directors have fixed the fee payable by Members to Dr Cameron at 2s. 6d. for each case upon which he is consulted : this fee should be sent to him along with the application for information.

Letters and parcels (carriage or postage paid) should be addressed to A. E. Cameron, Esq., M.A., D.Sc., Department of Agricultural and Forest Zoology, University of Edinburgh, 10 George Square, Edinburgh.

PREMIUMS OFFERED

1941

GROUP I.—REPORTS.

GENERAL REGULATIONS.

1. It is to be distinctly understood that the Society is not responsible for the views, statements, or opinions of any of the writers whose papers are published in the 'Transactions.'

2. All reports must be legibly written, and on one side of the paper only; they must specify the number and subject of the Premium for which they are in competition; they must bear a distinguishing motto, and be accompanied by a sealed letter, similarly marked, containing the name and address of the reporter—initials must not be used.

3. No sealed letter, unless belonging to a report found entitled to the Premium offered, or a portion of it, will be opened without the author's consent.

4. Reports for which a Premium, or a portion of a Premium, has been awarded, become the property of the Society, and cannot be published in whole or in part, or circulated in any manner, without the consent of the Directors. All other papers will be returned to the authors if applied for within twelve months.

5. The Society is not bound to award the whole or any part of a Premium.

6. All reports must be of a practical character, containing the results of the writer's own observation or experiment, and the special conditions attached to each Premium must be strictly fulfilled. General essays, and papers compiled from books, will not be rewarded or accepted. Weights and measurements must be indicated by the imperial standards.

7. The Directors, before or after awarding a Premium, shall have power to require the writer of any report to verify the statements made in it.

8. The decisions of the Board of Directors are final and conclusive as to all matters relating to Premiums, whether for Reports or at General or District Shows; and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

9. The Directors will welcome papers from any Contributor on any suitable subject, whether included in the Premium List or not ; and if the topic and the treatment of it are both approved, the writer may be remunerated and his paper published.

SECTION 1.—THE SCIENCE AND PRACTICE OF AGRICULTURE.

FOR APPROVED REPORTS.

1. On any useful practice in Rural Economy adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal. To be lodged by 1st November in any year.

The purpose chiefly contemplated by the offer of this premium is to induce travellers to notice and record such particular practices as may seem calculated to benefit Scotland. The Report to be founded on personal observation.

2. Approved Reports on other suitable subjects. To be lodged by 1st November in any year.

SECTION 2.—ESTATE IMPROVEMENTS.

FOR APPROVED REPORTS.

1. By the Proprietor in Scotland who shall have executed the most judicious, successful, and extensive Improvement—The Gold Medal, or Ten Pounds. To be lodged by 1st November in any year.

Should the successful Report be written for the Proprietor by his resident factor or farm manager, a Minor Gold Medal will be awarded to the writer in addition to the Gold Medal to the Proprietor.

The merits of the Report will not be determined so much by the mere extent of the improvements, as by their character and relation to the size of the property. The improvements may comprise reclaiming, draining, enclosing, planting, road-making, building, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

2. By the Proprietor or Tenant in Scotland who shall have reclaimed within the ten preceding years not less than forty

acres of Waste Land—The Gold Medal, or Ten Pounds. To be lodged by 1st November in any year.

3. By the Tenant in Scotland who shall have reclaimed within the ten preceding years not less than twenty acres of Waste Land—The Gold Medal, or Ten Pounds. To be lodged by 1st November in any year.

4. By the Tenant in Scotland who shall have reclaimed not less than ten acres within a similar period—The Medium Gold Medal, or Five Pounds. To be lodged by 1st November in any year.

The Reports in competition for Nos. 2, 3, and 4 may comprehend such general observations on the improvement of waste lands as the writer's experience may lead him to make, but must refer especially to the lands reclaimed—to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improvement—the details of the various operations—the mode of cultivation adopted—and the produce and value of the crops produced. As the required extent cannot be made up of different patches of land, the improvement must have relation to one subject; it must be of profitable character, and a rotation of crops must have been concluded before the date of the Report. *A detailed statement of the expenditure and return* and a certified measurement of the ground are requisite.

5. By the Proprietor or Tenant in Scotland who shall have improved within the ten preceding years the Pasturage of not less than thirty acres, by means of top-dressing, draining, or otherwise, without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten pounds. To be lodged by 1st November in any year.

6. By the Tenant in Scotland who shall have improved not less than ten acres within a similar period—The Minor Gold Medal. To be lodged by 1st November in any year.

Reports in competition for Nos. 5 and 6 must state the particular mode of management adopted, the substances applied, the elevation and nature of the soil, its previous natural products, and the changes produced.

SECTION 3.—HIGHLAND INDUSTRIES.

FOR APPROVED REPORTS.

1. The best mode of treating native Wool; cleaning, carding, dyeing, spinning, knitting, and weaving by hand in the Highlands and Islands of Scotland—Five Pounds. To be lodged by 1st November in any year.

SECTION 4.—MACHINERY.

FOR APPROVED REPORTS.

To be lodged by 1st November in any year.

SECTION 5.—FORESTRY.

FOR APPROVED REPORTS.

1. On Plantations of not less than eight years' standing formed on deep peat-bog—The Medium Gold Medal, or Five Pounds. To be lodged by 1st November in any year.

The Premium is strictly applicable to deep peat or flow moss; the condition of the moss previous to planting, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description grown on other soils in the vicinity.

GROUP II.—DISTRICT GRANTS.

APPLICATIONS.

Forms of Application may be obtained from the Secretary, 8 Eglinton Crescent, Edinburgh 12, which should be completed and returned on or before **1st November 1941**, in respect of a Grant commencing in the following year.

RENEWAL OF GRANT.—Applications for **renewal** of a particular Grant will be entertained only after the lapse of a specified interval of years (as undernoted) from the termination of the previous Grant, without prejudice, however, to the competency of applying in such intermediate years for a Grant in any other class.

Class.	Interval.
*1. Grants of £12 for Show Premiums for Horses, Cattle, Sheep, and Pigs	4 years.
2. Grants of £15 in respect of Stallions engaged for Agricultural purposes	3 years.
*3. Grants of Silver Medals in aid of Premiums	2 years.
4. Special Grants	—
5. Grants of £10 to Federations of S.W.R.I. for Show or Exhibition Prizes	2 years.

* NOTE.—Grants under Classes 1 and 3 have been suspended for the duration of the War.

CLASS 1.

LOCAL AGRICULTURAL SOCIETIES—GRANTS OF £12 FOR SHOW PREMIUMS FOR HORSES, CATTLE, SHEEP, AND PIGS.

REGULATIONS.—See previous Volume for Regulations and Rules of Competition.

GRANTS SUSPENDED THROUGHOUT THE WAR.—In January 1941 the Directors agreed that it was undesirable for the Society to encourage the holding of Agricultural Shows during the War, and it was decided, accordingly, that all grants by the Society of money and medals in aid of Local Agricultural Shows be suspended throughout the further duration of the War.

Accordingly, the undernoted Societies, which previously had been voted grants for the year 1941, will be entitled to such grants at the end of the War on resumption of their Shows, as follows:—

5th and Final Year—GRANT OF £12.

BOTHWELL FARMERS' SOCIETY.

DALSERF FARMERS' SOCIETY.

ISLAY, JURA, AND COLONSAY AGRICULTURAL ASSOCIATION.

4th (Intermediate) Year—3 SILVER MEDALS.

EASTERN DISTRICT OF STIRLINGSHIRE AGRICULTURAL ASSOCIATION.

ECHT, SKENE, AND MIDMAR AGRICULTURAL ASSOCIATION.

GLENKENS AGRICULTURAL SOCIETY.

KILLEARN AGRICULTURAL SOCIETY.

KILMACOLM AND PORT-GLASGOW AGRICULTURAL SOCIETY.

STRATHENDRICK AGRICULTURAL SOCIETY.

YARROW AND ETTRICK PASTORAL SOCIETY.

3rd (Alternate) Year—GRANT OF £12.

BATHGATE AGRICULTURAL ASSOCIATION.

BLACK ISLE FARMERS' SOCIETY.

CUMBERNAULD AGRICULTURAL SOCIETY.

DENNY AND DUNIPACE AGRICULTURAL ASSOCIATION.

FORMARTINE AGRICULTURAL ASSOCIATION.

ISLAY AGRICULTURAL ASSOCIATION.

NEILSTON AGRICULTURAL SOCIETY.

SKYE AGRICULTURAL SOCIETY.

STONEHOUSE AGRICULTURAL SOCIETY.

STRATHBOGIE FARMER CLUB.

2nd (Intermediate) Year—3 SILVER MEDALS.

CARNWATH AGRICULTURAL SOCIETY.

CROMAR, UPPER DEE, AND DONSIDER AGRICULTURAL SOCIETY.

DUNBARTONSHIRE AGRICULTURAL SOCIETY.

KENNETHMONT AGRICULTURAL ASSOCIATION.

LOCKERBIE AGRICULTURAL SOCIETY.

MID-ARGYLL AGRICULTURAL SOCIETY.

STEWARTRY AGRICULTURAL SHOW.

STIRLING AGRICULTURAL SOCIETY.

STRATHSPEY FARMERS' CLUB.

UPPER DEESIDE AGRICULTURAL ASSOCIATION.

1st Year—GRANT of £12

CARLUKE AGRICULTURAL SOCIETY.

LORN AGRICULTURAL SOCIETY.

UNITED EAST LOTHIAN AGRICULTURAL SOCIETY.

WESTERN DISTRICT OF MIDLOTHIAN AGRICULTURAL ASSOCIATION.

CLASS 2.

HORSE ASSOCIATIONS—GRANTS OF £15 IN RESPECT OF STALLIONS ENGAGED FOR AGRICULTURAL PURPOSES.

OLD REGULATIONS (applicable to Nos. 1 to 6 for the year 1941).

1. The Highland and Agricultural Society will make Grants to Horse Associations and other Societies in different districts engaging Stallions for agricultural purposes. The total sum expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £210 in any one year.

(*Note.*—As a special provision this sum has been raised to £300 for the year 1941.)

2. The portion of the Grant to any one Association or Society shall not exceed the sum of £15 in any one year. It is intended that the Grant shall be used by the Association or Society for the purpose of enabling it to secure a better class of Stallion.

3. The Grants will be available only for Stallions which, for the years to which the Grants apply, are registered in the Register of Certified Draught Stallions published by the Department of Agriculture for Scotland. (For information regarding the Registration of Stallions, apply to the Secretary of the Department of Agriculture for Scotland, St Andrew's House, Edinburgh.)

4. The Grant will continue for three years provided the Association receiving the Grant shall hire a Registered Stallion in the two intermediate years.

5. In the event of a Horse not being engaged in any one year while the provisions of the Grant are in force, the Grant made by the Highland and Agricultural Society will cease.

6. REGULATIONS 2 (Committee and Convener), 10 (Reports), 11 (Time of Payment), 12 (Renewal of Grant), and 13 (Disposal of Applications) applicable to Class 1, shall be applicable to this Class.

Grants in 1941.

5th and Final Year—GRANT OF £15.

1. CAITHNESS CLYDESDALE CLUB.

Convener—Donald Harrold, Lower Reiss, Wick, Caithness.

Secretary—John Gowans, Janestown, Wick, Caithness.

Granted 1937.

2. LANARK HORSE-BREEDING SOCIETY.

Convener—William Carruthers, Nethertown, Auchenh Heath, Lanarkshire.

Secretary—Alexander Clarkson, Pretts Mill, Lanark.

Granted 1937.

3. LORN ENTIRE HORSE SOCIETY.

Convener—Donald MacGillivray, Barcaldine Home Farm, Connel, Argyll.

Secretary—A. M. Cumming, National Bank of Scotland Ltd., Oban.

Granted 1937.

4. ORKNEY WEST MAINLAND HORSE-BREEDING SOCIETY.

Convener—Charles Hourston, Beaquoy Farm, Dounby, Kirkwall.

Secretary—John G. S. Flett, Nistaben Farm, Harray, Kirkwall.
Granted 1937.

5. STRATHBOGIE FARMER CLUB.

Convener—Alexander Dufton, Corse, Kinnoir, Huntly.

Secretary—John Stuart, Commercial Bank Buildings, Huntly.
Granted 1937.

6. WALLS AND HOY AGRICULTURAL SOCIETY.

Convener—James Baillie, Farm of Snelsetter, Longhope, Walls, Orkney.

Secretary—William Sutherland, The Old Custom House, Longhope, Walls, Orkney.

Granted 1935. (Grant in abeyance 1939, 1940.)

NEW REGULATIONS, 1941 (applicable to Nos. 7 to 20).

1. The Highland and Agricultural Society will make Grants to Horse Associations and other Societies in different districts engaging Stallions for agricultural purposes. The total sum expended by the Highland and Agricultural Society in such grants shall not exceed the sum of £210 in any one year.

(*Note*.—As a special provision this sum has been raised to £300 for the year 1941.)

2. *Application of Grant*.—The portion of the Grant to any one Association or Society shall not exceed the sum of £15 in any one year. It is intended that the Grant shall be used by the Association or Society for the purpose of enabling it to secure a better class of Stallion.

3. *Duration of Grant*.—The Grant will continue for three consecutive years.

4. *Registration of Stallions*.—The Grants will be available only for Stallions which, for the years to which the Grants apply, are registered in the Register of Certified Draught Stallions published by the Department of Agriculture for Scotland. (For information regarding the Registration of Stallions, apply to the Secretary of the Department of Agriculture for Scotland, St Andrew's House, Edinburgh.)

5. *Engagement of Stallions*.—In the event of a Horse not being engaged in any one year while the provisions of the Grant are in force, the Grant made by the Highland and Agricultural Society will cease.

6. *Renewal of Grant*.—An Association or Society which has received a Grant shall not be eligible to apply for a renewal of the

Grant until after the expiry of three years from the termination of the previous Grant.

7. REGULATIONS 2 (Committee and Convener), 10 (Reports), 11 (Time of Payment), and 13 (Disposal of Applications) applicable to Class 1, shall be applicable to this Class.

3rd and Final Year—GRANT OF £15.

7. NAIRNSHIRE FARMING SOCIETY.

Convener—Captain Joseph Mackay, Glebe End, Nairn.

Secretary—Archibald J. Mackintosh, St Colms, Auldearn, Nairn.

Granted 1938. (Grant in abeyance 1940.)

2nd Year—GRANT OF £15.

8. DEESIDE STOCK IMPROVEMENT SOCIETY.

Convener—John Thomson, J.P., Beanshill, Milltimber, Aberdeenshire.

Secretary—Peter Ross, 15 Westfield Road, Stonehaven.

Granted 1940.

9. LOWER DONSIDER HORSE-BREEDING SOCIETY.

Convener—Patrick Forbes, Aquherton, Kintore, Aberdeenshire.

Secretary—W. W. Allan Craig, P.O. Buildings, Kemnay, Aberdeenshire.

Granted 1940.

10. SHAPANSEY AGRICULTURAL ASSOCIATION.

Convener—William T. Wood, Balfour Mains, Shapansay, Orkney.

Secretary—D. L. Kemp, Bayview, Shapansay, Orkney.

Granted 1940.

11. STONEHAVEN DISTRICT HORSE-BREEDING ASSOCIATION.

Convener—A. E. Ergo, Cheyne, Stonehaven.

Secretary—James B. Connon, Commercial Bank Buildings, Stonehaven.

Granted 1940.

12. STRATHSPEY FARMERS' CLUB.

Convener—William Grant, Dell of Rothiemurchus, Aviemore.

Secretary—Mrs MacDougall, 2 The Square, Grantown-on-Spey.

Granted 1940.

13. UPPER DONSIDER AGRICULTURAL SOCIETY.

Convener—Alan Turnbull, Smithston, Gartly, Aberdeenshire.

Secretary—Alexander Kellas, Hillockhead, Cushnie, Alford, Aberdeenshire.

Granted 1940.

14. WEST OF CAITHNESS (CLYDESDALE) HORSE-BREEDING SOCIETY.
Convener—Captain J. H. Davidson, Lower Dounreay, Reay,
 Caithness.

Secretary—Andrew Innes, North Calder, Thurso, Caithness.
 Granted 1940.

15. WEST OF FIFE CLYDESDALE ENTIRE HORSE SOCIETY.

Convener—James Butters, Milton, Leuchars.

Secretary—John Stevens, Estate Office, Crossford, Dunfermline.

Granted 1940.

1st Year—GRANT of £15.

16. CLACKMANNANSHIRE UNION AGRICULTURAL SOCIETY.

Convener—Robert M'Gee, Blackfaulds, Alloa.

Secretary—G. F. Piggott, Union Street, Alloa.

Granted 1941.

17. HOWE O' THE MEARN'S HORSE-BREEDING ASSOCIATION.

Convener—.....

Secretary—Rowland Reed, Solicitor, Commercial Bank
 Buildings, Laurencekirk.

Granted 1941.

18. KIRRIEMUIR DISTRICT AGRICULTURAL ASSOCIATION.

Convener—Edward Weighton, Caddam, Kirriemuir.

Secretary—W. M. Wallace, National Bank of Scotland Ltd.,
 'Kirriemuir.

Granted 1941.

19. MORAYSHIRE CLYDESDALE HORSE-BREEDING ASSOCIATION.

Convener—S. Taylor, Kirkhill, Alves, Morayshire.

Secretary—A. J. Morrison, C.E., 87 High Street, Elgin.

Granted 1941.

20. SANDAY AGRICULTURAL ASSOCIATION.

Convener—James Irvine, West Brough, Sanday, Orkney.

Secretary—John Thomson, Orrie, Sanday, Orkney.

Granted 1940. (Grant in abeyance 1940.)

CLASS 3.

LOCAL AGRICULTURAL SOCIETIES—GRANTS OF SILVER MEDALS IN AID OF PREMIUMS.

REGULATIONS.—See previous Volume for Regulations and Rules
 of Competition.

GRANTS SUSPENDED THROUGHOUT THE WAR.—In January 1941
 the Directors agreed that it was undesirable for the Society to

encourage the holding of Agricultural Shows during the War, and it was decided, accordingly, that all grants by the Society of money and medals in aid of Local Agricultural Shows be suspended throughout the further duration of the War.

Accordingly, the undernoted Societies, which previously had been voted grants for the year 1941, will be entitled to such grants at the end of the War on resumption of their Shows, as follows:—

2nd Year.

MAUCHLINE HORTICULTURAL AND AGRICULTURAL SOCIETY.

ROTHIENORMAN AUTUMN EXHIBITION SOCIETY.

SOUTH UIST AND BENBECULA CATTLE SHOW SOCIETY.

VALE OF ALFORD AGRICULTURAL ASSOCIATION.

WEST LINTON AGRICULTURAL SOCIETY.

1st Year.

BLACKWATER, GLENSHEE, AND UPPER GLENISLA AGRICULTURAL ASSOCIATION.

EAST OF FIFE AGRICULTURAL SOCIETY.

CLASS 4.

SPECIAL GRANTS—1941.

(1) ANNUAL.

1. NORTHERN COUNTIES ARTS AND CRAFTS SOCIETY—£20.

Convener—Miss Mackintosh of Raigmore, Raigmore, Inverness.

Joint-Secretary—Mrs Mitford, Berryfield, Lentrane, Inverness.
Granted 1922.

2. SCOTTISH NATIONAL UNION OF ALLOTMENT HOLDERS.

£15 and 15 Medium Silver Medals to be offered as Prizes for best Allotments.

Secretary and Treasurer—Archibald W. Fisher, M.B.E., Solicitor, 18 Hill Street, Edinburgh.
Granted 1927.

3. SCOTTISH WOMEN'S RURAL INSTITUTES.

Grants of £3 each to Federations as prize-money in connection with a "Utility Garden Scheme" for encouraging increased production of vegetables in small gardens during the period of the War. On the basis of 32 Federations organising Competitions, the maximum amount of the grants will be £96.

Convener—The Countess of Elgin, D.B.E., Broomhall, Dunfermline.

Secretary—Miss M. T. Fergusson, M.B.E., Central Council Office, S.W.R.L., 7 North St David Street, Edinburgh.

Granted 1940.

Grants Suspended.

The respective grants to the undernoted Societies, &c., have been suspended for the further duration of the War (see reference under Class I.) :—

BRITISH WOMEN'S AGRICULTURAL ASSOCIATION.

GALLOWAY DAIRY PRODUCE SHOW SOCIETY.

SHETLAND FLOCK BOOK SOCIETY.

DAMHEAD AND DISTRICT GOAT-BREEDING ASSOCIATION,
MIDLOTHIAN.

Grants to the undernoted Societies have been suspended for the further duration of the War (see reference under Class I.). At the end of the War and on resumption of their Shows, the respective order of grants will be restored, as follows :—

- (1) IN ALTERNATE YEARS.—GRANTS OF £3, TO BE COMPETED
FOR AT THE ANNUAL SHOWS.

ROUSAY AGRICULTURAL SOCIETY, ORKNEY.

SOUTH RONALDSHAY AND BURRAY AGRICULTURAL SOCIETY,
ORKNEY.

SHAPANSEY AGRICULTURAL ASSOCIATION, ORKNEY.

- (2) IN ALTERNATE YEARS.—GRANTS OF £3 IN ABEYANCE.

ORKNEY AGRICULTURAL SOCIETY.

EAST MAINLAND AGRICULTURAL SOCIETY, ORKNEY.

WEST MAINLAND AGRICULTURAL SOCIETY, ORKNEY.

SANDAY AGRICULTURAL ASSOCIATION, ORKNEY.

YELL AGRICULTURAL SOCIETY, SHETLAND.

CLASS 5.

FEDERATIONS OF SCOTTISH WOMEN'S RURAL
INSTITUTES—GRANTS OF £10.

REGULATIONS, 1941.

1. The Highland and Agricultural Society of Scotland will provide annually a sum not exceeding £150 as special Grants to Federations of Scottish Women's Rural Institutes.

2. *Grant to Federation*, £10.—The amount of the Grant to any one Federation shall not exceed the sum of £10 per annum.

3. *Duration of Grant*.—The Grant will continue for two consecutive years.

4. *Disposal of Applications*.—In disposing of applications for Grants, the Directors of the Highland and Agricultural Society shall keep in view the length of interval that has elapsed since the expiration of the last Grant, giving priority to those Federations which have been longest off the list.

5. *Eligibility to Apply*.—All applications must be at the instance of a properly constituted Federation of Institutes.

6. *Application of Grant*.—The Grant of £10 shall not be applied as a Grant-in-aid to the general funds of a Federation, but must be offered in the form of Prizes at any Show or Competition held under the auspices of the Federation.

7. *Announcement of Grant*.—The offer of Prizes must be announced in the Prize List or Catalogue of the Show or Competition as "presented by the Highland and Agricultural Society of Scotland," or the amount of the Grant must be shown as a separate item of donation in the published statement of Accounts.

8. *Rules of Competition*.—The Rules of Competition for the Prizes, the funds for which are derived from Grants of the Highland and Agricultural Society of Scotland, shall be such as are generally enforced in the case of Prizes offered from the Federation's own funds.

9. *Report to be Submitted*.—Forms of Report will be furnished to the Secretaries of Federations, and these must be completed and returned to the Society as soon as possible after the Show or Competition and in no case later than 1st November. These Reports are subject to the approval of the Directors of the Highland and Agricultural Society, against whose decision there shall be no appeal. All Reports must be signed and certified as marked on the Form.

The Grant will lapse if no Report is lodged.

10. *Payment of Grant*.—Payment of the Grant will be made in December after the Reports of the Awards have been received and found to be in order and passed by the Board of Directors.

11. *Renewal of Grant*.—A Federation which has received a Grant for two consecutive years shall not be eligible to apply for a renewal of the Grant until after the expiry of two years from the termination of the previous Grant.

Grants in 1941.**2nd Year.****1. BERWICKSHIRE FEDERATION.**

Convener—Mrs Stevenson, Blackburn, Lauder, Berwickshire.

Secretary—Miss A. M'B. Cowan, Roselea, Oxtoun, Berwickshire.

Granted 1939. (Grant in abeyance 1940.)

2. DUMFRIESSHIRE FEDERATION.

Convener—Mrs Ralston, Holmhill, Thornhill, Dumfriesshire.

Secretary—Mrs Forrester, Kilness, Dumfries.

Granted 1939. (Grant in abeyance 1940.)

3. EAST LoTHIAN FEDERATION.

Convener—Mrs Hay, Belton, Dunbar.

Secretary—Mrs M'Kemmie, 2 Wemyss Place, Haddington.

Granted 1938. (Grant in abeyance 1938, 1940.)

4. MULL, ISLE OF, FEDERATION.

Convener—Mrs Allan of Aros, Tobermory.

Secretary—Mrs Cuninghame, Linndhu, Tobermory.

Granted 1939. (Grant in abeyance 1940.)

5. ROSS-SHIRE FEDERATION.

Convener—Mrs Ross, East House, Portmahomack, Ross-shire.

Secretary—Mrs M'Callum, Sliochd, Dingwall, Ross-shire.

Granted 1939. (Grant in abeyance 1940.)

1st Year.**6. BUTE, ISLE OF, FEDERATION.**

Convener—Miss M'Farlane, Meikle Kilchattan, Kingarth, Rothesay.

Secretary—Miss M. Gray Buchanan, St Margaret's, Ascog, Rothesay.

Granted 1940. (Grant in abeyance 1940.)

7. MIDLoTHIAN FEDERATION.

Convener—Mrs Mercer, Southfield, Dalkeith.

Secretary—Miss N. Scott Muir, 10 Silverknowes Loan, Davidson's Mains, Edinburgh 4.

Granted 1940. (Grant in abeyance 1940.)

8. STEWARTRY OF KIRKCUDBRIGHT FEDERATION.

Convener—Mrs Jaffo, Netherhall, Castle Douglas.

Secretary—Miss Stevenson, Douganhill, Dalbeattie.

Granted 1940. (Grant in abeyance 1940.)

GROUP III.—COTTAGES AND GARDENS, &c.

The following Premiums are offered for Competition.
The Premiums are granted for two years.

CLASS 6.**LOCAL SOCIETIES, &c.—GRANTS FOR BEST-KEPT
COTTAGES AND GARDENS.**

1. Best-kept Cottage	.	.	.	.	.	.	£1	0	0
Second best	.	.	.	.	.	.	0	10	0
2. Best-kept Cottage Garden	.	.	.	.	.	.	1	0	0
Second best	.	.	.	.	.	.	0	10	0

Forms of application may be obtained from the Secretary, and should be completed and returned on or before 1st November next, in respect of a Grant commencing in the following year.

RULES OF COMPETITION.

1. Competitions may take place in the different parishes for Cottages and Gardens, or for either separately.

2. The occupiers of Lodges at Gentlemen's Approach Gates and Gardeners' Houses are excluded, as well as others whom the Committee consider, from their position, not to be entitled to compete. The inspection must be completed by the 1st of October. In making the inspection, the Conveners may take the assistance of any competent judges.

3. It shall be left to the Committee in the District to fix two grades of Cottages, with maximum rents of £10 and £16 respectively, and to apply for Grants of £3 in respect of each.

4. To warrant the award of full Premiums, there must not be fewer than three Competitors in each class. If there are less than three Competitors in each class, only half Premium will be awarded.

5. A person who has gained the highest Premium cannot compete again.

6. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is thatch, it must be in good repair, though in the occupation of a tenant. The interior and external conveniences must be clean and orderly; the windows must be free of broken glass, clean, and affording the means of ventilation. Dung-hills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to Competitors who, in addition to the above requisites, have displayed

the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

7. In estimating the claims for the Garden Premiums, the judges should have in view—the sufficiency and neatness of the fences and walks: the cleanness of the ground; the quality and choice of the crops; and the general productiveness of the garden.

8. Reports, stating the number of Competitors, the names of successful parties, and the nature of the exertions which have been made by them, must be lodged with the Secretary of the Highland and Agricultural Society *on or before 1st November next*.

9. When a grant of Money has expired, the District cannot apply again for aid for four years.

Grants in 1941.

2nd Year.

1. DREGHORN HORTICULTURAL AND AGRICULTURAL SOCIETY.

Convener—Robert Pryde, Elms Lea, Dreghorn, Ayrshire.

Secretary—Hugh Gibson, 17 Perceton Cottages, Kilmarnock.

Granted 1939. (Grant in abeyance 1940 on account of War.)

1st Year.

2. OLD MELDRUM AND DISTRICT BRANCH S.W.R.I.

Convener—Mrs Morris, Kemp's Hotel, Old Meldrum, Aberdeenshire.

Secretary—Miss R. Borwick, 8 King Street, Old Meldrum, Aberdeenshire.

Granted 1939. (Grant in abeyance 1939-40 on account of War.)

3. STONEHOUSE HORTICULTURAL SOCIETY.

Convener—James C. Plenderleith, Westfield, Manse Road, Stonehouse, Lanarkshire.

Secretary—Robert M. Muter, 44 Camnethan Street, Stonehouse, Lanarkshire.

Granted 1939. (Grant in abeyance 1939-40 on account of War.)

CLASS 7.

LOCAL SOCIETIES, &c.—GRANTS OF MINOR SILVER MEDALS FOR BEST-KEPT COTTAGES AND GARDENS, GARDEN PRODUCE, POULTRY, AND HONEY.

RULES OF COMPETITION.

1. The Society will give annually one or two Minor Silver Medals to a limited number of local Associations or individuals, who estab-

lish Competitions and Premiums for Cottages, Gardens, Garden Produce, or Bee-Keeping. The Medals will be granted for two years.

2. The Medals may be offered in any two of the following sections, *but under no circumstances will the two Medals be given in one of the sections :—*

- (1) Best-kept Cottage or best-kept Cottage and Garden. (One Medal only.)
- (2) Best-kept Garden. (One Medal only.)
- (3) Best Collection of Garden Produce—Flowers excluded. (One Medal only.)
- (4) Best Pen of Poultry. (One Medal only.)
- (5) Honey. (One Medal only.)

3. The annual value of each cottage, with the ground occupied in the parish by a Competitor, must not exceed £20. The occupiers of Lodges at Gentlemen's Approach Gates, and Gardeners in the employment of others, are not entitled to compete.

4. If Competition takes place for Garden Produce, such produce must be *bona fide* grown in the Exhibitor's Garden. He will not be allowed to make up a collection from any other Garden. The produce must consist of Vegetables, or Vegetables and Fruit (not Fruit alone). Flowers are excluded.

5. The Honey must be the produce of the Exhibitor's own Hives.

6. To warrant the award of a Medal, there must not be fewer than three Competitors.

7. Forms of Report of Competitions will be furnished to the Secretaries in the different Districts. These must, in all details, be completed and lodged with the Secretary of the Highland and Agricultural Society as soon as possible after the Competition, and in no case later than *1st November*, for the approval of the Directors, against whose decisions there shall be no appeal.

8. If no Competition takes place in a District for two years the grant expires.

9. When a grant of Medals has expired, the District cannot apply again for a similar grant until after the lapse of a period of two years.

Grants in 1941.

2nd Year.

1. DREGHORN HORTICULTURAL AND AGRICULTURAL SOCIETY.

Convener—Robert Pryde, Elms Lea, Dreghorn, Ayrshire.

Secretary—Hugh Gibson, 17 Perceton Cottages, Kilmarnock.

Granted 1939. (1 Medal.) (Grant in abeyance 1940 on account of War.)

2. ROTHIE-NORMAN AUTUMN EXHIBITION SOCIETY.

Convener—John W. Cruickshank, Logie Newton, Rothie-norman, Aberdeenshire.

Secretary—James Simpson, Brownhill, Rothienorman, Aberdeenshire.

Granted 1938. (1 Medal.) (Grant in abeyance 1939-40 on account of War.)

1st Year.**3. GLASGOW CORPORATION TRANSPORT RECREATION CLUB.**

Secretary—R. Weir Berrie, 46 Bath Street, Glasgow, C.2.

Granted 1940. (1 Medal.) (Grant in abeyance 1940 on account of War.)

4. OLD MELDRUM AND DISTRICT BRANCH S.W.R.I.

Convener—Mrs Morris, Kemp's Hotel, Old Meldrum, Aberdeenshire.

Secretary—Miss R. Borwick, 8 King Street, Old Meldrum, Aberdeenshire.

Granted 1939. (1 Medal.) (Grant in abeyance 1939-40 on account of War.)

5. STONEHOUSE HORTICULTURAL SOCIETY.

Convener—James C. Plenderleith, Westfield, Manse Road, Stonehouse, Lanarkshire.

Secretary—Robert M. Muter, 44 Camnethan Street, Stonehouse, Lanarkshire.

Granted 1939. (1 Medal.) (Grant in abeyance 1939-40 on account of War.)

GROUP IV.—PLOUGHING, HOEING, AND LONG FARM SERVICE.

1. MEDALS FOR PLOUGHING COMPETITIONS.

The Ploughing Medal will be given to the winner of the first Premium at Ploughing Competitions, provided a Report in the following terms on the official form is made to the Secretary, within one month of the Competition, by a Member of the Society. Forms of Report to be had on application.

FORM OF REPORT.

I, _____ of _____, Member of the Highland and Agricultural Society, hereby certify that I attended the Ploughing Match of the _____ Association at _____ in the county of _____ on the _____ when _____ ploughs competed ; _____ of land were assigned to each, and _____ hours were allowed for the execution of the work. The sum of £ _____ was awarded as follows :—

[Here enumerate the names and designations of successful Competitors.]

RULES OF COMPETITION.

1. All Matches must be at the instance of a Local Society or Ploughing Association, and no Match at the instance of an individual, or confined to the tenants of one estate, will be recognised.

2. The title of such Society or Association, together with the name and address of its Secretary, must be registered with the Secretary of the Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh.

3. Not more than one Match in the same season can take place within the bounds of the same Society or Association.

4. All reports must be lodged within one month of the date of the Match, and certified by a Member of the Highland and Agricultural Society who was present at it.

5. A Member can report only one Match ; and a Ploughman cannot carry more than three Medals in the same season.

6. To warrant the grant of the Medal, there must have been 12 Ploughs in actual competition for the medal (*i.e., in the particular class for which the medal was offered*) and not less than £3 awarded in Prizes by the Local Society. The Medal to be given to the winner of the first prize.

7. The Local Society or Ploughing Association shall decide what class of ploughs shall compete for the Medal, and if so agreed, may offer it for competition to the class of plough most generally in use in the district.

8. The Local Society or Committee may, if they desire, arrange to let each Ploughman have one person to guide the horses for the first two and the last two furrows, but in no case shall Ploughmen receive any other assistance, and their work must not be set up or touched by others. Attention should be given to the firmness and sufficiency of the work below, more than to its neatness above the surface.

9. The Local Committee is required to fix the time to be allowed for ploughing the portion of land, and they are recommended that the time be at the rate of not more than fourteen hours per imperial acre on light land, and eighteen hours on heavy or stony land.

NOTE.—The attention of the Directors of the Society has frequently been drawn to certain irregularities which have occurred in connection with the conduct of Ploughing Matches and the completion of the Reports thereon. Complaints have been made (a) that the allotted amount of ground has not been ploughed, within the specified time, by the competitor awarded the first prize; (b) that the Report sent to this Society has been signed by a Member of the Society who was not present at the Match. It has to be pointed out that any infringement of the above Rules by a Local Society or Ploughing Association will render that Society or Association liable, at the discretion of the Board of Directors, to be debarred from receiving the Society's Medals.

2. MEDALS FOR HOEING COMPETITIONS.

The Minor Silver Medal will be given to the winner of the first Premium at Hoeing Competitions, provided a Report on the official form is made to the Secretary within a month of the Competition by a Member of the Society. Forms of Report to be had on application.

RULES OF COMPETITION.

1. All Matches must be at the instance of a Local Society or Hoeing Association, and no Match at the instance of an individual, or confined to the tenants of one estate, will be recognised.

2. The title of such Society or Association, together with the name and address of its Secretary, must be registered with the Secretary of the Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh.

3. Not more than one Match in the same season can take place within the bounds of the same Society or Association.

4. All reports must be lodged within one month of the date of the Match, and certified by a Member of the Highland and Agricultural Society who was present at it.

5. A Member can only report one Match; and same Competitor cannot carry more than three Medals in the same season.

6. To warrant the grant of the Medal there must have been twelve hoes in Competition, and not less than Three Pounds awarded in prizes by the Local Society or Association. The Medal to be given to the winner of the first prize.

7. The time to be allowed to be decided by the local Committee, but in no case to exceed two hours for two drills of 100 yards each, the third drill being unoccupied, so that Competitors do not interfere with their neighbour's work.

8. Competitors must finish their work as they go along—no turning back or after-dressing allowed. Hand-picking or transplanting shall be strictly prohibited.

9. A Committee shall be appointed to watch the work, and any Competitor found transplanting or otherwise not complying with the Rules shall have his number withdrawn, and be debarred from receiving any prize which might otherwise have been awarded to him.

NOTE.—Medals will be awarded under similar conditions for Competitions in hand-singling.

3. CERTIFICATES AND MEDALS FOR LONG FARM SERVICE.

Certificates and Silver Medals for long service will be awarded by the Society to farm servants, male or female, having an approved service in Scotland of not less than thirty years (not necessarily continuous) —(a) with one employer on the same or different holdings ; (b) on the same holding with different employers.

Special Certificates and Gold Medals are also awarded to farm servants, male or female, having an approved service in Scotland of not less than forty-five years (not necessarily continuous), on similar conditions of employment as the above.

Forms of Application are obtainable from the Secretary, 8 Eglinton Crescent, Edinburgh.

War Service to count towards the time required for qualification, where farm servants have returned to same service or employment with same farmer or his family.

The award is strictly confined to **Farm** workers, such as Ploughmen, Cattlemen, and Shepherds.

Domestic and House Servants and Estate workers, such as Foresters, Carters, Grooms, &c., are not eligible.

MEMBERS ADMITTED SINCE THE LIST WAS PUBLISHED IN APRIL 1939.

ARRANGED ACCORDING TO SHOW DISTRICTS.

(ELECTED 5TH JUNE 1940 AND 8TH JANUARY 1941.)

1.—GLASGOW DIVISION

ARGYLL

Admitted

1940 Smith, Ailie Mackenzie, Lochavich, Taynuilt

1941 Wright, James Montgomery Byng, of Auchinellan and Ommaig, Auchinellan, Ford,
Lochgilthead

AYR

1940 Turner, Arthur L. (Westcon, Ltd.), 41 Mill Street, Ayr

LANARK

1941 Baxter, J. C., Woodlands, Thankerton

1940 MacGregor, Adam R. (P. & R. Fleming & Co.), 20 Argyle Street, Glasgow

1940 MacGregor, G. Eric (James MacGregor, Ltd.), Garrion Grain Mills, Wishaw

1940 MacGregor, J. Sim (James MacGregor, Ltd.), Garrion Grain Mills, Wishaw

1941 M'Leod, Ralph (Galloway & M'Leod, Ltd.), The Cross, Stonehouse

1940 Mungall, Alexander C., Gartcraig Farm Dairy, Glasgow, E.1

RENFREW

1940 Nelson-Scott, Mrs C. Coats, Woodside, Giffnock

4.—EDINBURGH DIVISION

MID-LOTHIAN

1940 Thin, Russell Gibson, 4 Lindsay Place, George IV. Bridge

6.—DUMFRIES DIVISION

WIGTOWN

1940 Douglas, William Todd, Greenpoint, Cairnryan Road, Stranraer

7.—INVERNESS DIVISION

MORAY

1940 Stokes, George, Easter Gallowie, Grantown-on-Spey

NORTHERN IRELAND AND EIRE

1940 Cuthbertson, H. S., Hillcrest, Dundonald, Co. Down

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MEMBERSHIP OF SOCIETY.

CONDITIONS OF MEMBERSHIP

HIGHER SUBSCRIPTION.

The ordinary annual subscription is £1, 3s. 6d., and the ordinary subscription for life-membership is £12, 12s. ; or after ten annual payments have been made, £7, 7s.

LOWER SUBSCRIPTION.

Proprietors farming the whole of their own lands, whose rental on the Valuation Roll does not exceed £500 per annum, and all Tenant-Farmers, Secretaries or Treasurers of Local Agricultural Associations, Factors resident on Estates, Land Stewards, Foresters, Agricultural Implement Makers, Grain, Seed and Manure Merchants, Agricultural Auctioneers, Cattle Dealers and Veterinary Surgeons, none of them being also owners of land to an extent exceeding £500 per annum, and such other persons as, in respect of their official or other connection with Agriculture, the Board of Directors may consider eligible, are admitted on a subscription of 10s. annually, which may be redeemed by one payment of £7, 7s., and after eight annual payments of 10s. have been made, a Life Subscription may be purchased for £5, 5s., and after twelve such payments for £3, 3s.*

According to the Charter, a Member who has not objected to his election, on the same being intimated to him by the Secretary, cannot retire until he has paid, in annual subscriptions or otherwise, an amount equivalent to a life composition.

* Candidates claiming to be on the 10s. list must state under which of the above designations they are entitled to be placed on it.

ELECTION OF MEMBERS

Candidates for admission to the Society must be proposed by a Member, and are elected at the half-yearly General Meetings in January and June. It is not necessary that the proposer should attend the Meeting.

PRIVILEGES OF MEMBERS

MEMBERS OF THE SOCIETY ARE ENTITLED—

1. To receive a free copy of the 'Transactions' annually.
2. To apply for District Premiums that may be offered, and Long Service Medals.
3. To report Ploughing Matches for Medals that may be offered.
4. To Free Admission to the Shows of the Society.
5. To reduced rates for exhibits in the Society's Shows if elected at, or before, the General Meeting of Members in January of the year of the Show.
6. To have Manures and Feeding Stuffs analysed at reduced fees.
7. To have Insect Pests and Diseases affecting Farm Crops inquired into.
8. To attend and vote at General Meetings of the Society.
9. To vote for the Election of Directors, &c., &c.

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